MAY, 1953

TOOLING and PRODUCTION

The Magazine of Manufacturing Management

T.P.

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Putnam takes the shank off the end mill . . .
. . . puts it on a holder that soon pays for itself.
Eliminate integral tapered shanks and cumbersome tool changing on heavy end mill jobs with the new, proven Postiv-Lok end mills. They'll cut your end mill costs up to 25%, give smooth, chatter-free cutting through torque-aided locking. Write for catalog on your letterhead.
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"TRU-THREAD" THREAD DRESSING TOOLS

DIAMOND GRIT TOOLS FOR THREAD DRESSING

INDUSTRIAL DIAMONDS

A Mountain of Light, and a Star

When the royal crown is placed upon a British monarch's head, the soft lights of Westminster Abbey dance upon some of the most beautiful jewels in existence, including two of the world's greatest diamonds—the Koh-i-noor and the Great Star of Africa.

The Koh-i-noor, or "Mountain of Light," was found four thousand years ago in the legendary diamond fields of the King of Golconda. War, conquest, torture, theft, assassination and barter brought it to princes, moguls, shahs and rajahs, and brought tragedy, too, so the legend says, except when it was worn by a woman. Originally it weighed 800 carats, but cutting has reduced it to 106½ and greatly increased its beauty. It adorns the front of the Queen's crown.

The Great Star of Africa, set into the top of the royal scepter, weighs 516½ carats and is the largest cut diamond in the world. The original stone weighed 3,025 carats (about a pound and a half) and although it was the largest diamond ever found, was, obviously, but part of a much larger stone, still undiscovered.

The Great Star was found in 1905, just five years before this company was founded, and came from Premier Mine No. 2 in South Africa, which produces many of the fine industrial diamonds which we have imported for our customers during our 43 years. Our field engineers are at your service.

WHEEL TRUEING TOOL COMPANY

5-3200 West Davison Avenue • Detroit 6, Michigan

ESTABLISHED 1910

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RUGGED, LOW COST AIR CYLINDER WITH BUILT-IN VALVE SETS NEW STANDARDS FOR FAST, PRECISION OPERATIONS

Built-in electrical operating controls, built-in 4-way valve, built-in dual piston rod speed regulators, all with a single air connection, simplify installation of economical pneumatic circuits.

Any repetitive push, pull or lift movement now done manually can be performed infinitely faster, safer, and at lower cost with this unique, electrically-controlled Bellows Air Motor. The range of work it can do is limited only by the imagination of the tool designer or production engineer.

Unlike conventional air cylinders which require separate remote valves and cumbersome piping, The Bellows Air Motor is a complete power unit. It is compact, fits into crowded quarters, on moving machine elements. It is fast, responds to a starting impulse instantly. It is safe. Its low voltage operation simplifies wiring. It is sturdy, records of 10,000,000, 15,000,000, even 30,000,000 cycles without maintenance or repairs are commonplace.

The Bellows Air Motor is made in a wide range of mounting styles; in five bore sizes to meet varying power requirements; and in standard stroke lengths up to 48". For mechanical or manual operation the Air Motor can be equipped with a built-in manual valve, or for operation in explosive-hazardous areas with the built-in explosion-proof electrically controlled valve.

The Bellows Air Motor gives you an entirely new conception of the productive possibilities of air power. In the thousands of manufacturing plants where it is in use, it is establishing daily new records for cost reduction and improved productive efficiency. In metal working, in plastics, in woodworking, in any industry you can name, these versatile power units are sparking the imagination of cost conscious production men looking for ways to do old and new jobs better.

WRITE FOR THIS FREE 36-PAGE BOOKLET

HERE IN THESE QUICK-READING PAGES IS THE STORY OF "CONTROLLED-AIR-POWER"—WHAT IT IS DOING FOR OTHERS—WHAT IT CAN DO FOR YOU. THERE IS NO COST, NO OBLIGATION. ADDRESS: DEPT. TP-553, THE BELLOWS CO., BELLOWS BLDG., AKRON 9, OHIO. ASK FOR BULLETIN CL-30.

The Bellows Co.
AKRON 9, OHIO

1464-1

BELLOWS "CONTROLLED-AIR-POWER" DEVICES FOR FASTER, SAFER, BETTER PRODUCTION

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR INFORM-A-GRAM KEY NUMBERS

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It's easy to choose the right reamer with the NEW Reamer Selector

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TOOLING and PRODUCTION

The Magazine of Manufacturing Management

formerly
Tool-Die-Machine PROGRESS 1934-41
TOOL & DIE JOURNAL 1941-51

Vol. XIX—No. 2 May, 1953

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TOOLING and PRODUCTION'S great appeal is to those men who operate the plants and divisions of industry, their production departments and their toolrooms. It is they who collectively are charged with the responsibility of manufacturing their companies' products precisely, efficiently and profitably.

They have the influence that enables them to adopt the ideas and the processes which TOOLING and PRODUCTION describes in every issue AND the authority to recommend, to specify and/or to buy everything that may be needed to reduce costs, increase production or improve quality. These men for whom, each month, our editors seek out or write TOOLING and PRODUCTION'S meticulously accurate stories of "Know-How" and "Tell-How" are T & P's exclusive Cycle of Buying Influence (CBI) in their plants.

Every copy is directed to these men by name, by title and by company address. Please see our CCA verification.

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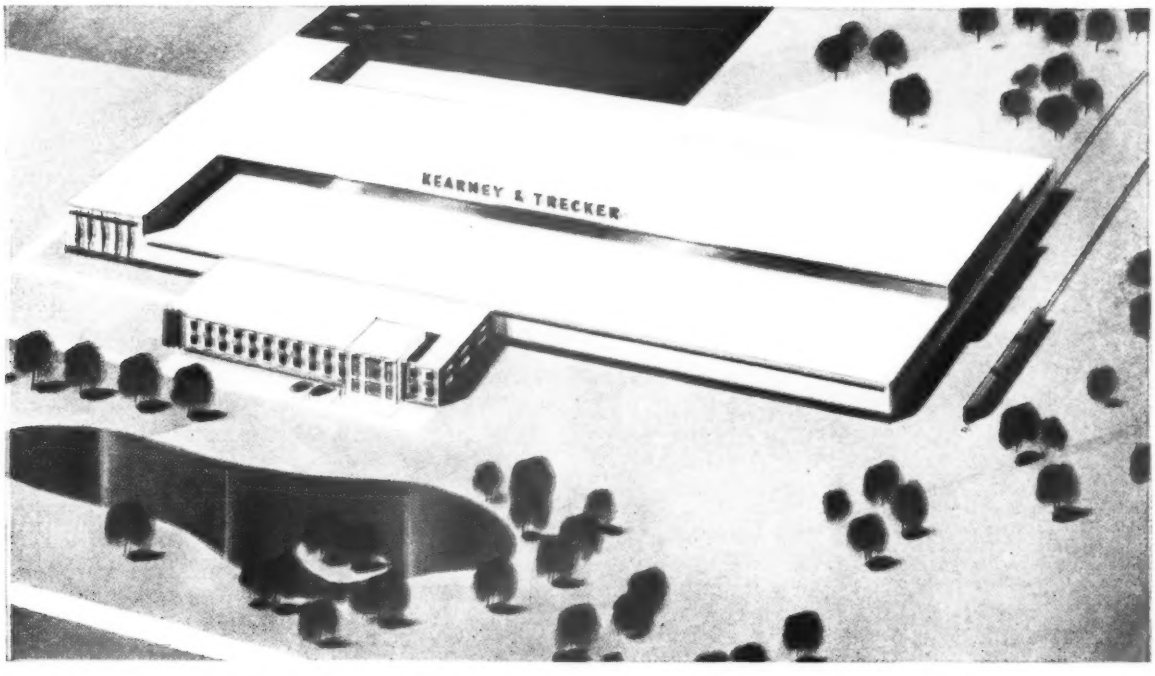
Tooling and Production ★ Die Designing and Estimating ★ Plastics Molds
The Know-How-Library of Tooling and Production



Here it is! Kearney & Trecker's new Special Machinery Division — nearly 200,000 sq. ft. of new plant with new tools and equipment. An experienced, fully-staffed team of sales, engineering and production experts is ready and waiting to serve you . . . by engineering new production methods.

INCUBATOR . . . for Production Ideas

This plant is being built for you . . . to engineer *new* production methods — to build the large or small special machines, tools and fixtures you need to improve production and cut costs.

Production behind schedule?

Costs going up, up and up?

Will special machines, special tools and fixtures or special arrangements of standard machines help you solve these problems?

Then why not be among the first to take advantage of the 5-million-dollar-plus investment that Kearney & Trecker is making in new plant, new tools and new engineering to help you solve them.

Kearney & Trecker *is no newcomer* to the field of special machine tools and allied special equipment. During the past 50 years millions of dollars worth of Kearney & Trecker special machinery has been produced for plants all over the world. And that doesn't include the 60,000 standard Kearney & Trecker milling machines and other machine tools so well known and so widely accepted everywhere.

Kearney & Trecker is already working on new production ideas, new equipment and tool designs to be produced in this plant. Kearney & Trecker Special Engineering and Methods Analysts are ready right now to serve you with (1) Prompt response to your inquiry, (2) Immediate engineering help on your problem, plus, (3) The newest, finest and most complete facilities to build the special equipment you need — big or small.

Phone, write or wire The Special Machinery Division, Kearney & Trecker Corporation, Milwaukee 14, Wis., today. Get the facts about Kearney & Trecker's Special Machinery Division and how it can serve you.

KEARNEY & TRECKER
MILWAUKEE
MACHINE TOOLS

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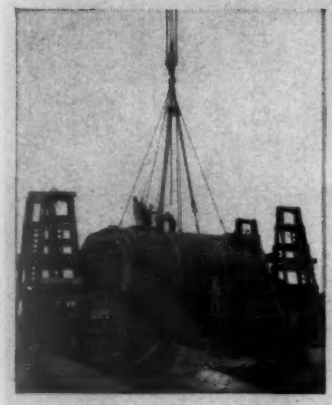
Here a Cincinnati Press Brake saves 3 ways...



Built at The Maryland Drydock Company, for the Westinghouse Electric Corporation these giant condensers are some of the largest ever constructed.

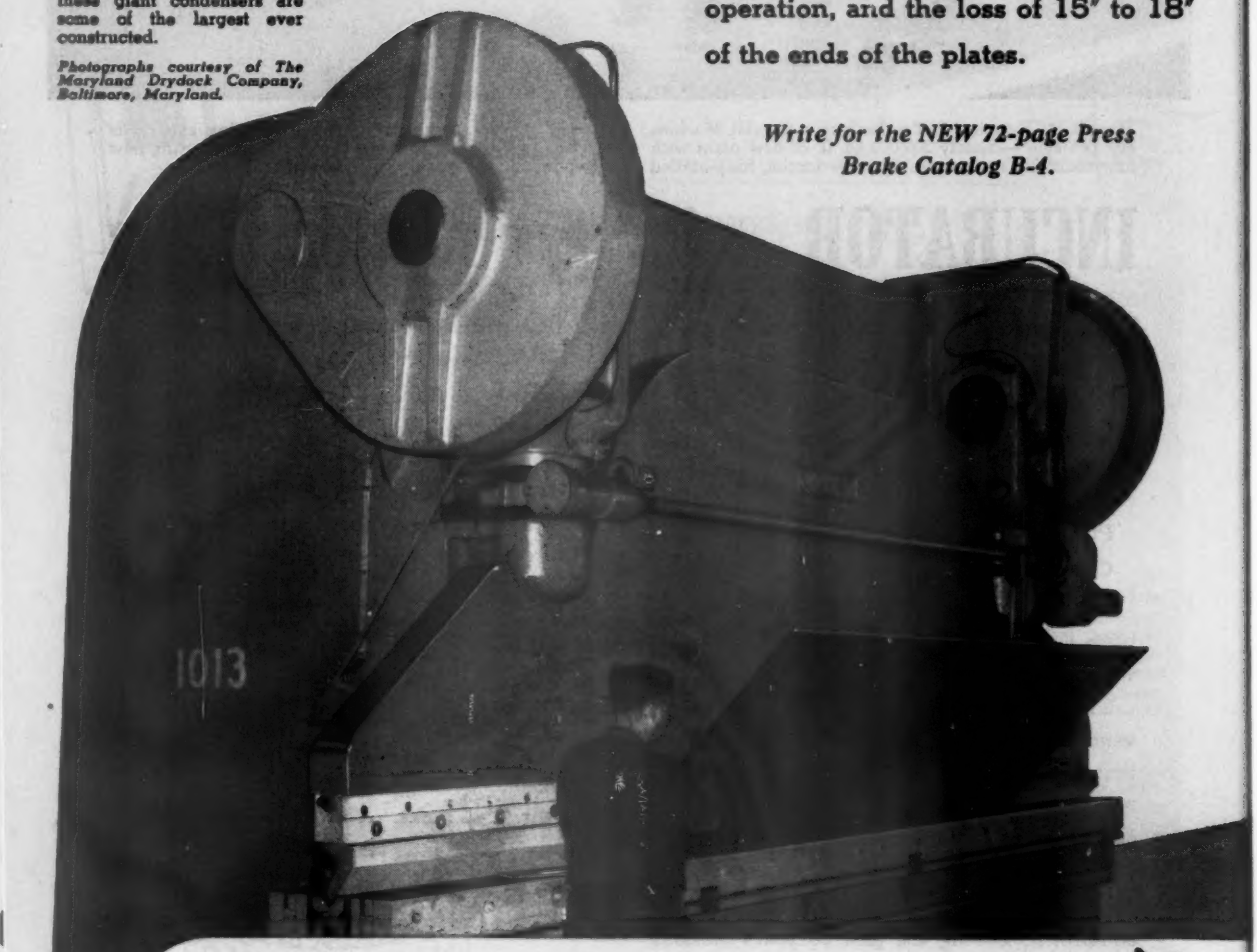
Photographs courtesy of The Maryland Drydock Company, Baltimore, Maryland.

- TIME
- NUMBER OF OPERATIONS
- MATERIAL

Crimping plate up to 3″ thicknesses has cut roll-forming time in half at The Maryland Drydock Company.

The press brake crimps the ends of the plates with special dies, and has eliminated both the costly burning operation, and the loss of 15″ to 18″ of the ends of the plates.

Write for the NEW 72-page Press Brake Catalog B-4.



THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

CINCINNATI

GORTON *Brings You* High Production

Automatic Profiling of CAMS AND CAM-LIKE SHAPES

Gorton Contour Mill, CM-12, Produces Extreme Accuracy and High-Surface Finish with Minimum Maintenance

This machine produces highly accurate, identical pieces — complicated cam shapes, external or internal, or continuous grooves and slots of irregular radii. The Gorton Contour Mill is easy to use and versatile — a simple tracer-controlled, vertical-head milling machine with two rotary power-driven tables. No complicated electronic, hydraulic or pneumatic controls.

CAPACITY . . .

Wide spindle-speed range — 300 rpm to 10,000 rpm — for either high-speed steel or carbide cutters, burrs or grit grinding wheels. The 16-inch master-copy table easily accommodates larger master cams. Several thin cams can be stacked and profiled at once.

EXTREME ACCURACY . . .

Operation depends upon a heavy, single-pivot beam which provides more accuracy than can be built into the tooling. A choice of several reduction ratios adds to accuracy and provides low micro-inch finishes. The reduction ratio principle produces piece parts to closer tolerances than those of the master.

CUSTOM-DESIGNED . . .

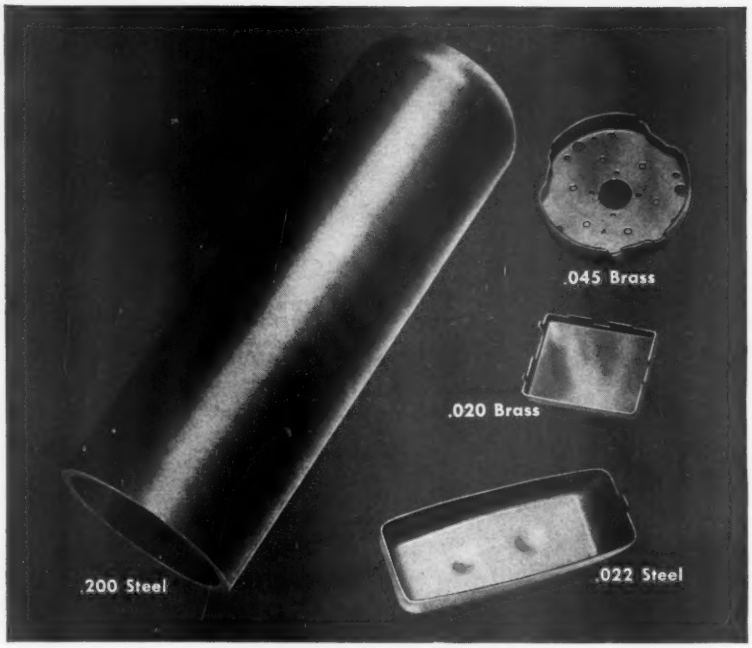
The basic machine is standard, but each mill is tooled for specific work. Because all machine elements are individually motor-driven, the machine can be adapted to a wide range of applications. Write for complete details and your copy of Special Bulletin 2390-C-1205

GEORGE GORTON MACHINE CO.

1205 RACINE STREET • RACINE, WISCONSIN, U.S.A.

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR INFORM-A-GRAM KEY NUMBERS

ONE Brehm Die
using various cutting adapters



Reduces Original Cost . . . Cuts Operating Costs!

When model or part changes interrupt production, only the cutting adapters of a Brehm Die need to be replaced to continue full production. Don't overlook the fact that a single Brehm Die, using various cutting adapters, greatly reduces the original investment, to say nothing of reducing current operating costs.

The Brehm "Shimmy" Die has angular cams which cause the shearing edges to cut four ways in a single press stroke. Higher production and lower costs are possible because "pinch" and slow, costly "horn" trimming operations are eliminated. Materials, thicknesses, shapes and sizes can vary. Such as gold, silver, plastic, rubber, aluminum, copper, brass, zinc, stainless or mild steel. A refrigerator door, the case of a lady's watch, an artillery case, a business machine, aircraft or automotive part.

Perfect edges, clean, without burrs or distortion at the trimmed edge. Contours can be straight or curved, with single or multiple notches and projections.

For a free Brehm Die Catalog, write today. If you wish, and without obligation, send us your blueprint or the part for complete information or quotation.

THE "SHIMMY" REG. DIE®

Brehm
TRIMMING DIES

THE STEEL PRODUCTS ENGINEERING CO.

BREHM DIE DIV., DEPT. 13 SPRINGFIELD, OHIO

Talk of the Month

The Automatic Factory?

by D. S. Harder
Vice President, Manufacturing
and D. J. Davis
FORD MOTOR COMPANY
Dearborn, Michigan

Industry today is in the midst of a continuing plant expansion and improvement program which began during World War II and has continued since the early part of the 1940 - 1950 decade.

Fortunately, during this period, a considerable amount of plant expansion for production of domestic products was possible to take care of our expanding population. Immediately after World War II, the emphasis was often on production without regard for long term modernization of plant and production processes. Since then, however, there has been sufficient time to plan for many facilities which are new from the ground up and which utilize the latest known devices for production at a lower cost and a higher quality.

Some of these newer facilities have been publicized in the newspapers, magazines and trade journals of the country, and many people have the impression that a large number of automotive factories are now completely automatic.

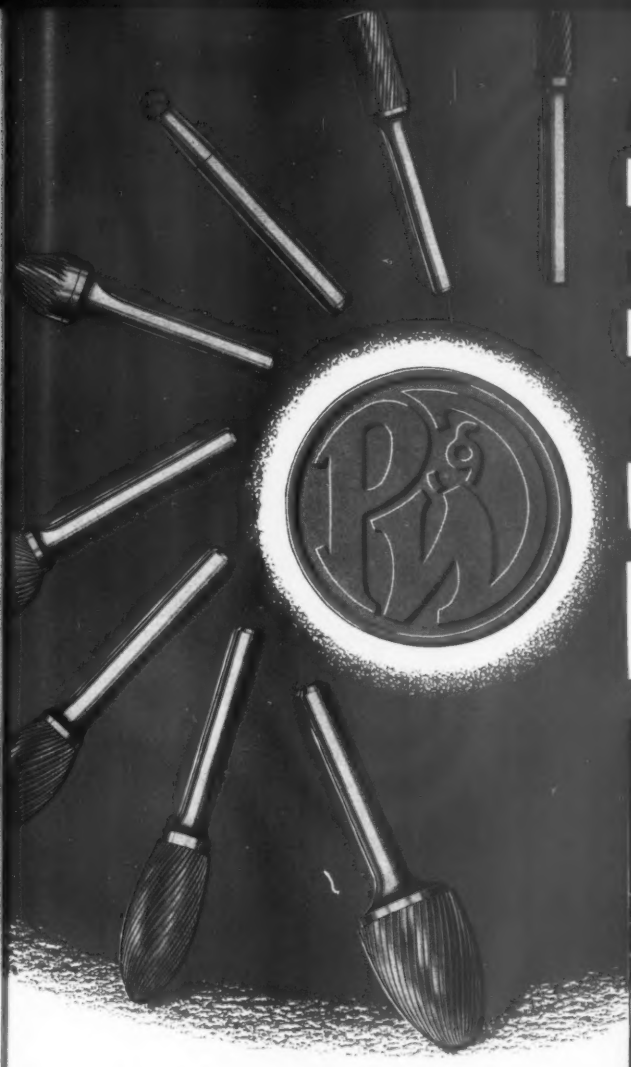
This is not the case, and we feel that the completely automatic factory is still some distance in the future. We do have, however, some new factories which are based on the automatic handling of parts in some departments; and, the future will see new plants with a greater percentage of automatic operations as our manufacturing engineers and the builders of our machinery and equipment take advantage of the experience gained in the latest programs.

Please keep in mind that we are talking about automotive factories. Our plants are ordinarily quite large, containing as much as one million square feet of floor space

. . . Continued on page 32

From a paper presented before the recent SAE National Production Meeting held at Cleveland, Ohio, under sponsorship of the Society of Automotive Engineers, Inc.

FOR PRODUCT INFORMATION USE CONVENIENT INFORM-A-GRAM CARD



MORE DIFFERENT JOBS DONE BETTER and FASTER with KELLERFLEX BURS

Precision in every respect, Pratt & Whitney Kellerflex Burs give more efficiency . . . cut faster, smoother, longer than any other cutting tool of this type. Here are some reasons why:

CORRECT DESIGN — Rake angle, flute helix, spacing are right for your jobs because P&W leads in scientific Bur Engineering.

FINE MATERIALS — Correct grade of carbide and expertly heat-treated high speed steel, mean keen cutting edges and longer cutting life.

MASTER-GRINDING by MACHINE — From hardened solid blanks *was originated by Pratt & Whitney* to assure complete concentricity, uniform flute spacing and form, and superior balance so essential to smooth cutting without chatter or bounce. No hand-ground bur can match this performance. At P&W, "machine-grinding" means "100% by machine" — human error is eliminated.

EXACT DUPLICATES — All P&W Burs of the same size and shape (there are 14 standard shapes plus dozens of specials) are exactly alike. You can order replacements by number and always get identical performance.

USED ON KELLERFLEX FLEXIBLE SHAFT MACHINES . . .

. . . like the Series M shown above, you have smoothness, ample power and speed range to obtain maximum performance from Kellerflex Burs. Smaller and larger models are also available. Write on your Company letterhead to the Pratt & Whitney Branch Office nearest you — or direct to West Hartford. Ask for Circular No. 521-2 on the "Series M" Machine.

GET COMPLETE, MONEY-SAVING INFORMATION NOW. Write on your Company letterhead to the Pratt & Whitney Branch Office nearest you — or direct to West Hartford. Ask for the new P&W Kellerflex Bur Catalog.

PRATT & WHITNEY
DIVISION NILES-BEMENT-POND COMPANY
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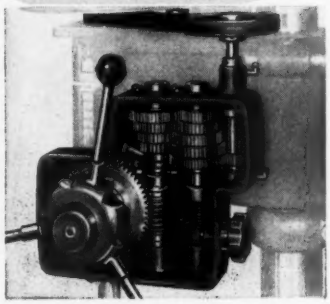
MACHINE TOOLS • CUTTING TOOLS • GAGES

NEW!

CLAUSING

18" HEAVY-DUTY POWER FEED DRILL PRESS



★ Drills 1" cast iron, ¾" steel ★ No. 3 Morse Taper, 6½" spindle travel ★ HEAVY-DUTY GEAR-DRIVEN POWER FEED TO TAKE FULL ADVANTAGE OF THIS BIG TOOL AND JOB CAPACITY.

An 18" *heavy-duty* drill press, with larger tool and job capacity, PLUS a *heavy-duty* GEAR-DRIVEN power feed to make effective use of its capacity — those are the brief facts about this fine new Clausing development.

The power feed, with its large heavy-duty gears, is positive and sure — NO belt slippage to reduce power. Feed selection is instant — BY DIAL — no belts to change. Add the Clausing features of new spindle bearing engineering, vernier depth stop, and exclusive head and table positioning mechanism — and you know this is a tool that can save you plenty on both set-up and operating time. Get all the facts — send for new literature today.

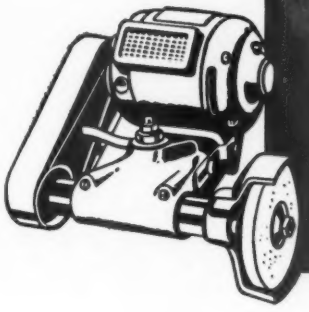
Atlas CLAUSING PRECISION MACHINE TOOLS — DIVISION ATLAS PRESS COMPANY KALAMAZOO, MICHIGAN U.S.A.

CLAUSING DIVISION ATLAS PRESS COMPANY
5-115 N. PITCHER ST., KALAMAZOO, MICHIGAN

FOR PRODUCT INFORMATION USE CONVENIENT INFORM-A-GRAM CARD

26-year record proves DUMORE® GRINDERS give low-cost, accurate service

Mounted on a Universal Grinder, the Dumore operates at a spindle speed of 40,000 rpm. Work speed is 300 rpm.



How DUMORE insures high-speed internal grinding with mirror finish . . . at low cost

MANUFACTURING drill chucks requires a difficult jaw grinding operation. Smooth finish and correct back taper are necessary. And each day, the grinder must stand up under millions of hammer-like blows transmitted by the jaws to the grinding wheel and spindle bearings.

Since 1927, this chuck manufacturer has used DUMORE precision grinders. Here is his report:

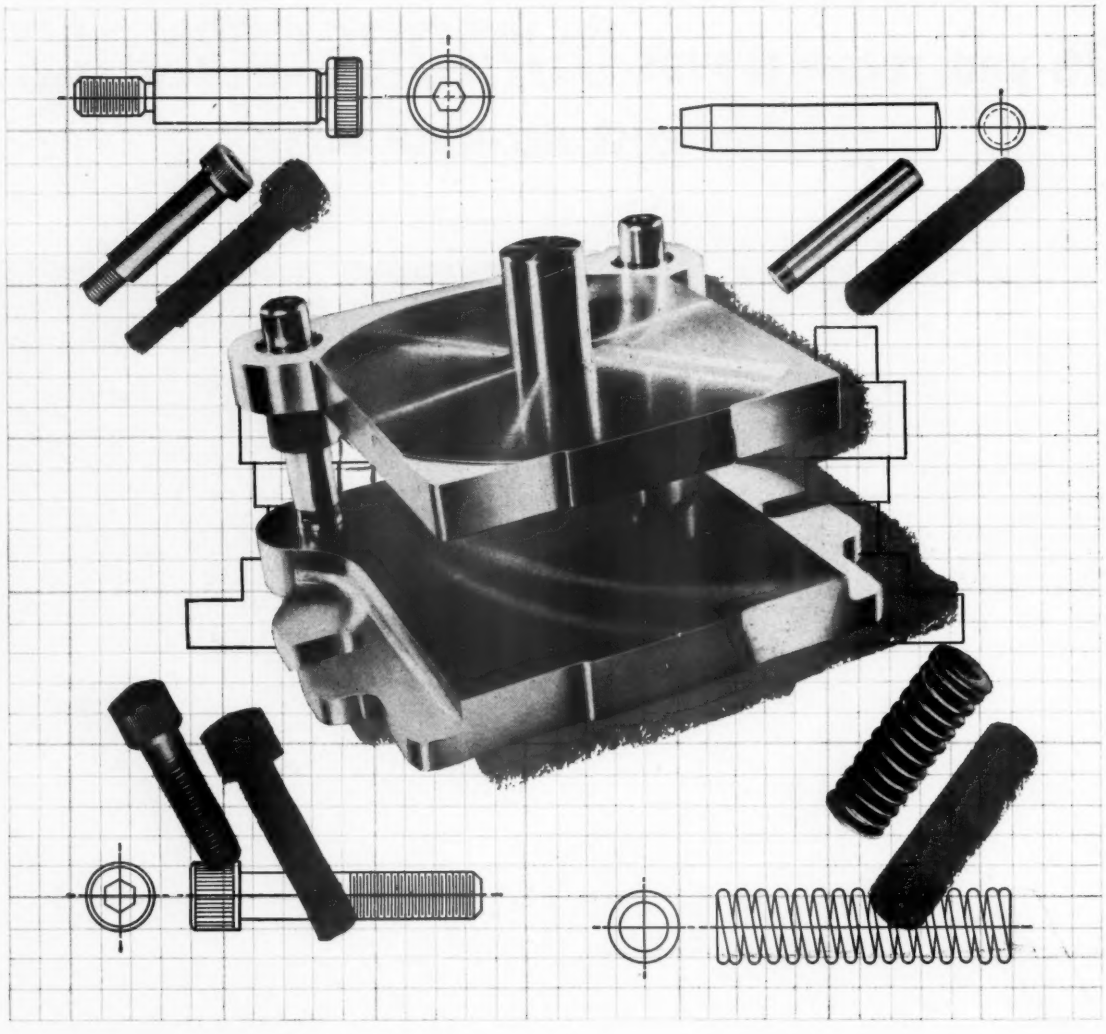
"Our Dumore No. 5 units operate 100 hrs. per week for the internal grinding of 3 open jaws for our ⅛" to 1" plain bearing key type chucks. The material is 60 Rockwell C hardness alloy steel and we remove .005".

"The Dumores are well adapted to this fine work and produce a glass-like finish. Their sturdy power transmission, solid spindle shaft, self-oiling features, air-cooled motor and variable speeds make them exceptionally well suited for this work. They deliver continuous operation with little effort and very low maintenance cost."

If you are seeking a way to improve your internal grinding operations, investigate the advantages Dumore grinders can provide. Get the details from your industrial distributor or write direct:

THE DUMORE COMPANY
1313 Seventeenth Street • Racine, Wisconsin

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR INFORM-A-GRAM KEY NUMBERS



THERE'S A DANLY STANDARD TO MEET YOUR DIEMAKING SPECIFICATIONS

In nearly every instance, Danly can meet your diemaking specifications with *standard* Danly Die Sets and *standard* Danly Diemakers' Supplies. Eliminate delay between design and production . . . you can be sure of prompt delivery from completely stocked Danly branch assembly plants located in major toolmaking centers.

More than 30 years' experience in supplying diemakers' needs has established Danly's reputation for design excellence and dependable accuracy. Diemakers everywhere *prefer* Danly!

Plan now for faster tooling *and* longer production runs at less cost . . . with Danly Die Sets and Danly Diemakers' Supplies.

Call Your Local Danly Branch Today!

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***PHILADELPHIA** 40 511 W. Courtland St.
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**Indicates complete stock*

DANLY

DANLY MACHINE SPECIALTIES, INC.
2100 South Laramie Avenue
Chicago 50, Illinois

DIE SETS AND DIEMAKERS' SUPPLIES

JONES & LAMSON GUARANTEES CLASS III THREADS with REPETITIVE ACCURACY!

J & L Automatic Opening Die Heads are sold with this guarantee: that your threads will be held consistently within the exacting Class III tolerances for form, lead and pitch diameter, throughout the long life of the J & L chasers.

RADIAL CHASER TYPE
Capacities from #8 to 4¼"

TANGENT CHASER TYPES
Stationary and Revolving. Capacities from #4 to 2"

Some of the reasons why:

COMPACT, RUGGED DESIGN GIVES MAXIMUM SUPPORT TO THE CHASERS. J & L Dies are made of solid steel, no built-up sections, hardened and precision ground throughout. Chasers are supported at the point of, and in the direction of, maximum strain.

THREAD FORM, HELIX, PRECISION POINT HEIGHT, ARE ALL GROUND INTO CHASERS AFTER HARDENING. This gives you a freer cutting tool, operating with minimum wear and repetitive Class III accuracy. The high precision of the J & L chasers is maintained in the Die by exclusive chaser holding features.

EASY, CONTROLLED RESHARPENING. J & L chasers are resharpened independently of the holders or dies. Instructions are simple, easy to follow. Eliminates guesswork. Exclusive holding features assure accurate resetting.

P.S. *Only J & L Die Heads and Chasers give you ALL these features. Write to Dept. 710 for illustrated catalogs and complete information.*

JONES & LAMSON

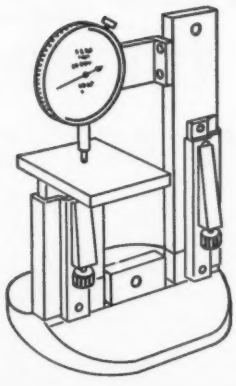
Machine Tool Craftsmen Since 1835

JONES & LAMSON MACHINE CO., 519 Clinton St., Dept. 710, Springfield, Vt., U.S.A. J&L **DIE HEAD DIVISION**

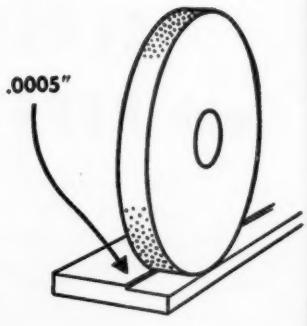
SEE ADVERTISERS INDEX, BACK OF BOOK, FOR INFORM-A-GRAM KEY NUMBERS

CAN YOUR SURFACE

1. Remove .020" from a 2" x 3" piece of oil hardened tool steel using a .020" automatic crossfeed at each end of the stroke —material to Rockwell 59-60 C scale.



2. Remove the work and measure its thickness. For extreme accuracy use DoALL Gage Blocks with Micro-Step accessories or electric comparator.



3. Put the work back on the machine and zero the elevating hand wheel (slip ring on the DoALL hand wheels make this a quick, easy job.) Now set the hand wheel to .0005" and cut across ⅓ of the work

New 1953 DoALL Precision Surface Grinders Establish New Standard of Performance

THE test described above is just one of several that prove the accuracy, rigidity and matchless performance of DoALL Surface Grinders.

There is no give, no wheel ride-up, no play in a DoALL Grinder. Accurate duplication of parts, time savings and elimination of spoiled pieces are the advantage of true precision work. With a DoALL Surface Grinder your operator will not have to remove the work from the chuck and measure it for size. The DoALL Grinder will accurately produce parts to a predetermined tolerance from the hand wheel setting.

Surface grinding is often the *starting point* for accurate work and generally the *finishing point* when close tolerances are required. There is no substitute for perfection in surface grinding—can your grinder pass the DoALL test?

Proof of these claims can be yours without cost or obligation. Simply ask for a free demonstration. Operate a DoALL Surface Grinder in your plant, on your own work, and see how precision grinding will reduce operating costs.

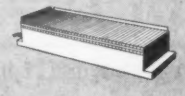
Call your local DoALL Sales-Service Store, or write:

THE DoALL COMPANY

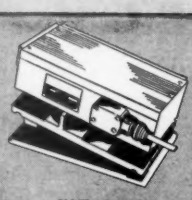
254 N. Laurel Avenue **Des Plaines, Illinois**

GR-9

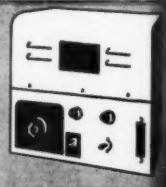
BAND MACHINES



MAGNETIC CHUCK

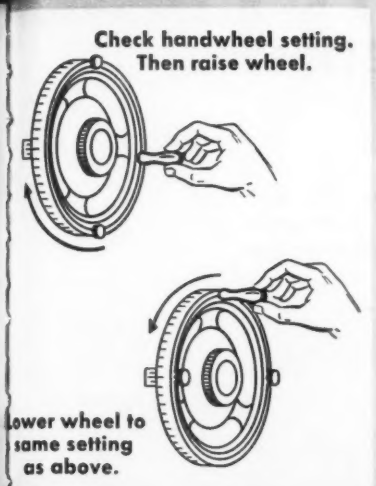


SINE CHUCK

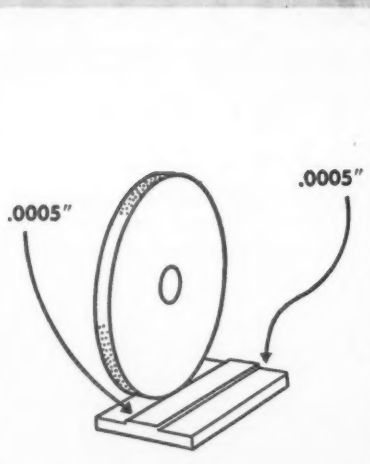


SELECTRON

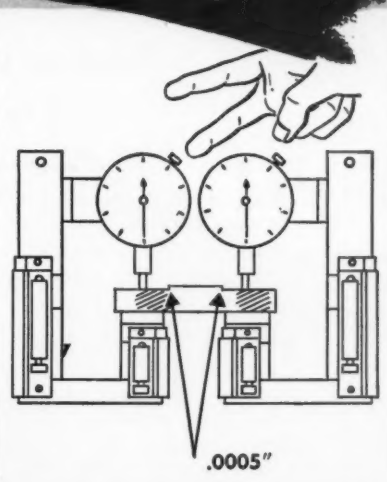
GRINDERS DO THIS?



4. Check the hand wheel setting, then raise the grinding wheel. Now move the work piece to the opposite side and lower the grinding wheel to the exact setting of the preceding cut.



5. Now take another cut across ½ of the work on the surface opposite the first cut. The resulting cut should be precisely the same if your grinder is capable of accurate duplication.



6. Prove it! Measure three points in each cut with precision measuring instruments. If you make this test with a DoALL Grinder you'll find the work is perfect—the cuts *are exactly the same depth!*

New Models . . . New Sizes DoALL Surface Grinders for TOOLROOM and PRODUCTION Work

•

Patented Cool Grinding Time Saving Accessories

D-6 Models—6" x 18" and 6" x 24" sizes. Manual and hydraulic operation. 7" wheels.

D-8 Models—8" x 24" with 10" or 14" wheels. Manual and hydraulic operation.

D-10 Models—10" x 30" with 10" or 14" wheels. 12½" work height capacity, all models.

Table travel speed up to 100 fpm.

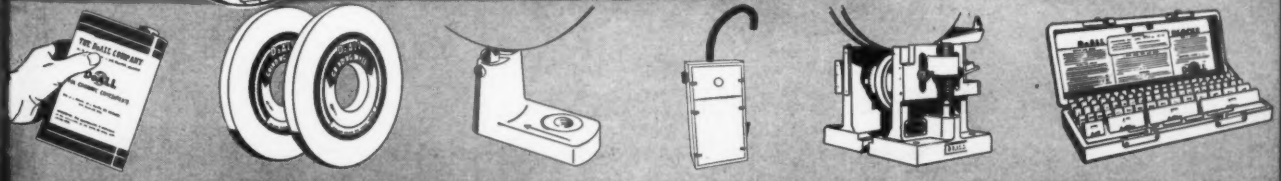
Available with new recirculating "Cool-Grinding" System.

Complete line of attachments and accessories for surface, cylindrical and form grinding.

Model D-10 Grinder with complete automatic, electric remote control system.

Write for NEW Catalog

DoALL



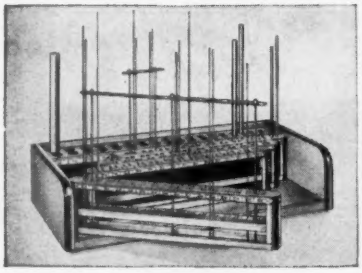
COOLANTS | GRINDING WHEELS | DIAMOND DRESSER | DUST COLLECTOR | CRUSH ROLLS | GAGE BLOCKS

inexpensive

. . . Money Saving Accessories For Your Plant

Each of the accessories illustrated and described below was designed and built for a definite need and used in our own plant before being offered to industry. They require a relatively small investment, yet will save you money every day. For further information, write for the folder offered below.

DRILL ROD RACK

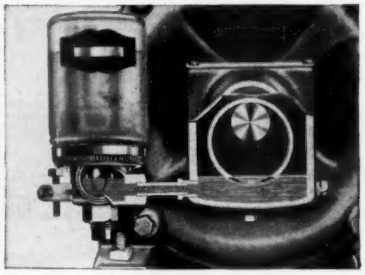


Eliminate trouble and waste effort with this modern method of storing drill rod. Put the Acro rack in a central location of each department and make it simple for each mechanic to select correct rod size in a hurry. It also provides a visual inventory for checking rod replacements.
Accommodates 26 letter sizes, 52 pieces; 47 fractional sizes, 138 pieces; 60 number sizes, 304 pieces. Fractional sizes graduated in 64ths from 1/32" to ½" and in 32nds from ½" to 1" included.

LEADER PIN OILERS

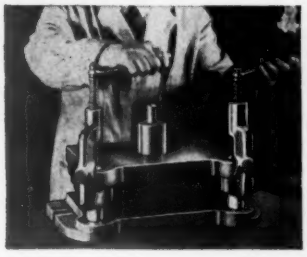
Eliminate wear on your die sets with these leader pin oilers. Acro Pin Oilers, as illustrated, fit over each leader pin and seals in place with a rubber neoprene washer. Each cup is filled with oil so each downward stroke brings bushing in contact with oil and each upward stroke distributes oil evenly over leader pins. Eliminate bushing wear, leader pin scoring, and maintains die accuracy. Die sets equipped with Acro Pin Oilers have run under tests for several weeks to a month without refilling.

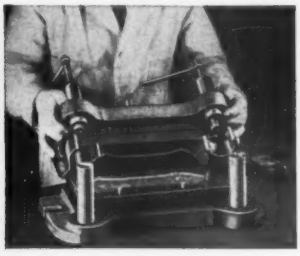
AUTOMATIC LUBRICATORS



With this Acro lubricator, you can lubricate oil ring, capillary, ball or roller bearings on electric motors, blowers, lineshafts and similar bearings for periods as long as six months to one year with one filling. You can save 50 to 95 per cent in oil consumption, practically eliminate maintenance labor and burned out bearings due to faulty hand oiling and guesswork. In addition to savings effected in labor and maintenance, Acro lubricators soon pay for themselves in oil savings alone.

DIE SET PULLERS





The principle of the Acro Die Set Puller is to remove the punch holder from the die shoe by a straight upward pull, whereby punch holder travels upward from die shoe axially, leaving both leader pins simultaneously. This is accomplished only by use of the indexed screw wrenches which act as indicators, controlling the upward travel. This is an exclusive patented Acro feature, found only in Acro Die Set Pullers.

Free Data

covering each of these profitable accessories is included in our folder. Write for bulletin TP-52.

ACRO

METAL STAMPING CO.

330 EAST RESERVOIR AVE.

MILWAUKEE 12, WIS.

FOR PRODUCT INFORMATION USE CONVENIENT INFORM-A-GRAM CARD

the one source

for "Desegatized" high speed tool steels

ELECTRITE
6-6-M2

ELECTRITE
HV-6

ELECTRITE
TATMO

ELECTRITE
TNW

ELECTRITE
CO-6

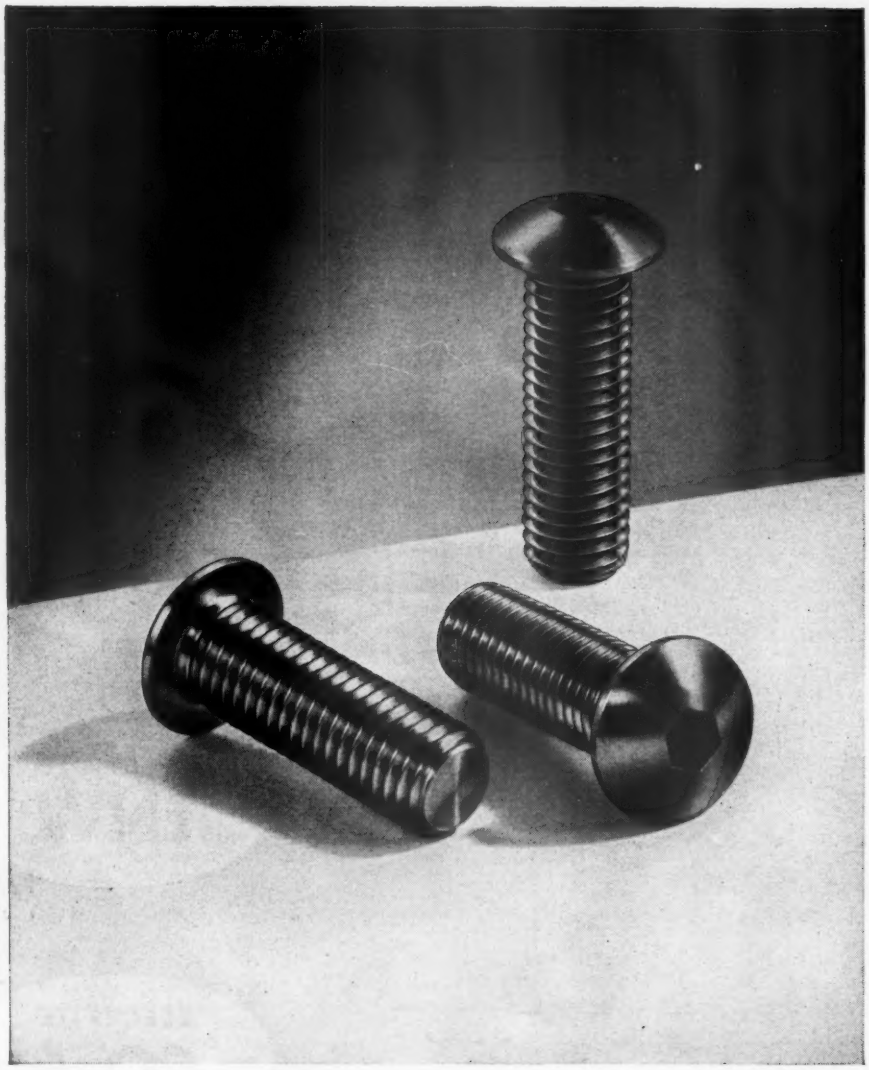
CONTACT YOUR LOCAL LATROBE REPRESENTATIVE

LATROBE STEEL COMPANY

Latrobe, Pennsylvania

Sole Producers of "DESEGATIZED" Steels

BRANCH OFFICES AND WAREHOUSES IN PRINCIPAL CITIES

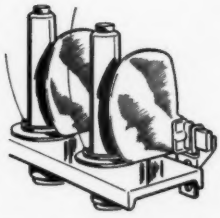


UNBRAKO BUTTON HEAD SOCKET SCREWS feature the following: threads to head; low head height; nonslip internal wrenching; hex socket that minimizes possibility of marred or mutilated heads; fully formed threads—Class 3 fit; heat treated alloy steel; standard sizes from #8 through ⅝" diameter.

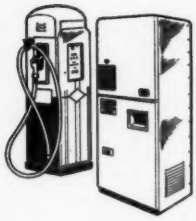
Our Fiftieth Year

A START FOR THE FUTURE

USE UNBRAKO BUTTON HEAD SCREWS on transportation equipment—door and window frames, paneling, seats.



On textile machinery—slashers, twisters, bobbin shields.



On sheet metal assemblies—beverage coolers, gasoline pumps.

Have you checked our UNBRAKO standards?

We suggest you do, because a standard UNBRAKO delivered from your distributor's stock means faster and better service. A standard will do the job as well as a special at much lower cost. For details about UNBRAKO Standards, write SPS, Jenkintown 36, Pa.

Write for UNBRAKO Standards

UNBRAKO® SOCKET SCREW DIVISION

SPS JENKINTOWN PENNSYLVANIA

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WANT TO GRIND IN MILLIONTHS?

for MORE PRODUCTION
BETTER SURFACE FINISHES
TOLERANCES IN THE MILLIONTHS

use these P-2500 Series Spindles. They have the extra power, bearing capacity and rigidity to do the job.

Write for new Catalog No. 58A

POPE

TRADE MARK REG. U.S. PAT. OFF.

POPE MACHINERY CORPORATION
ESTABLISHED 1920
261 RIVER STREET • HAVERHILL, MASSACHUSETTS
BUILDERS OF PRECISION SPINDLES

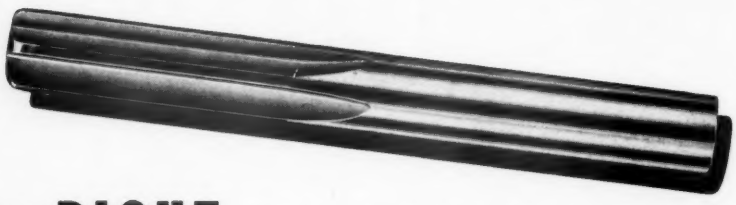
No. 52

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR INFORM-A-GRAM KEY NUMBERS

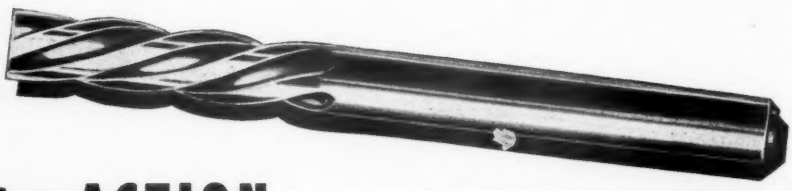
ATRAX

is for ATRAX . . . the finest of cutting tools.

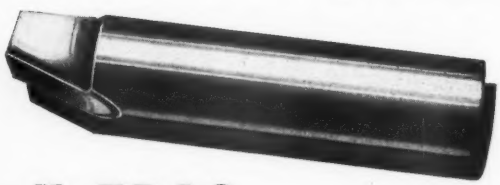
is for TOUGH . . . they're *solid tungsten carbide.*



is for RIGHT . . . they're precision ground-from-the-solid.



is for ACTION . . . when Atrax tools solve difficulties in your production line.



is for X-TRAS . . . Atrax tools give with longer service, less trouble, better profits.

Representatives and Distributors in principal cities in United States and Canada. Write for name of representative in your area.

Send for complete catalog NOW!

THE ATRAX COMPANY

NEWINGTON 11, CONNECTICUT

FOR PRODUCT INFORMATION USE CONVENIENT INFORM-A-GRAM CARD

FOR ALL YOUR DIE SET NEEDS . . .

SPECIFY SUPERIOR DIE SETS

For Fast Local Service Call these Expert Superior Representatives

- Kalamazoo, Mich.—Phone 7988
- Indianapolis, Ind.—BRoadway 5668
- Chicago, Ill.—CEntral 6-3860
- Dallas, Tex.—Riverside 5138
- Syracuse, N. Y.—3013 James St.
- Rockford, Ill.—Phone 3-3991
- St. Louis, Mo.—Lucas 1223
- Milwaukee—Mitchell 5-6027
- Dayton, Ohio—Hemlock 6209
- Atlanta, Ga.—ATwood 7771
- Detroit, Mich.—Lincoln 1-2836

Precision Workmanship, Wide Range of Die Set Sizes, Safer, Easier to Handle

Superior precision workmanship, wide range of die sets and exclusive *Safety Flanges, Lock Jaw Lifting Device* and *E. Z. Lift Sling Chain* speed die production from bench to press and eliminate needless risks in handling die sets. Risks that might easily injure the hands of skilled die makers, ruin costly dies in process or completed, or even damage press equipment.

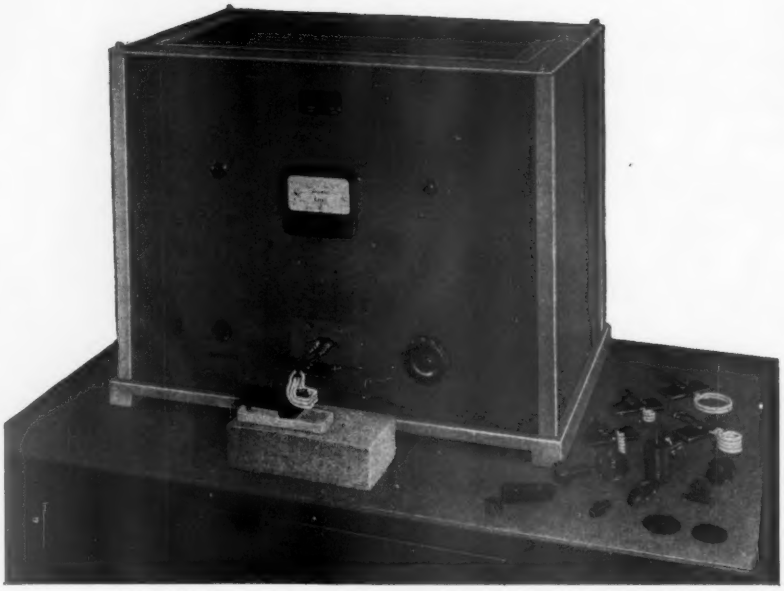
Superior engineers will help determine your needs and can show you how Superior Die Sets have eliminated these handling dangers.

Write for free descriptive catalog No. S-100—that gives you complete details on how you can cut your Die making costs and speed handling.

SUPERIOR STEEL PRODUCTS CORP.
2754 S. 19th ST., MILWAUKEE, WIS.

Lepel presents

A *Low Cost* PORTABLE HIGH FREQUENCY *Induction* HEATING UNIT

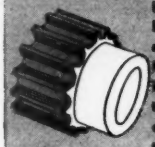


BRAZING

Permits widest choice of silver or copper brazing alloys from lowest to highest melting points. Ideal for brazing carbide tips.

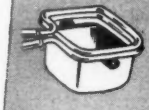
HARDENING

Heat localized exactly where wanted at desired temperature. Ideal for gears, cams, bearing surfaces, cutting tools and other areas that are subject to wear.



SOLDERING

Speedily and neatly performs intricate soldering applications with or without the use of pre-formed rings.

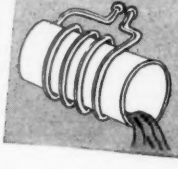


ANNEALING

Ideal for annealing, stress-relieving, normalizing or pre-heating selected areas.

MELTING

Readily melts quantities of ferrous and non-ferrous metals in either graphite or ceramic crucibles.



- **SMALL AND COMPACT**
  Conveniently operated on bench or table—no mounting necessary.
- **ECONOMICAL OPERATION**
  No special power installation required. Operates on 110 volts, 60 or 50 cycle line at unity power factor.
- **FULLY GUARANTEED**
  Guaranteed for continuous duty cycle and stated performance.

This versatile unit is priced so low that every shop may now take advantage of modern induction heating techniques to improve quality and to increase production. Its simplicity of operation eliminates the need for skilled personnel.

The Lepel Model 2 KW will meet the requirements of machine shops, toolrooms, research laboratories and educational institutions. It is especially suitable for hardening, brazing and soldering small parts of either ferrous or non-ferrous metals.

Complete unit with line connection and load coil.

$870.
f.o.b. factory

WILL HEAT TO 1500° F.

⅛"	steel	rod	1"	length	in	approx.	1 second
¼"	"	"	"	"	"	"	3 seconds
½"	"	"	"	"	"	"	15 seconds
1"	"	"	"	"	"	"	60 seconds

Will melt 4 ounces of brass or steel in 4 minutes.
Equally well suited for heating of non-ferrous metals.

LEPEL HIGH FREQUENCY LABORATORIES, INC.
55th STREET and 37th AVENUE, WOODSIDE 77, NEW YORK CITY, N. Y.

All Lepel equipment is certified to comply with the requirements of the Federal Communications Commission.
WRITE FOR LEPEL CATALOG TP-5

THREE REAL REASONS WHY

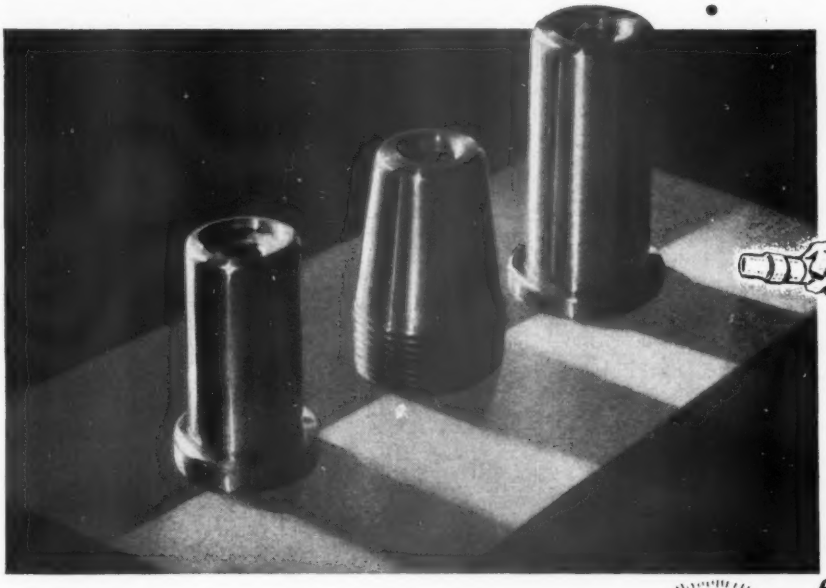
you should use the NORBIDE Pressure Blast Nozzle:

1. More service per dollar cost (750 hours silica sand — 1500 hours steel grit or shot). Norton guarantees this minimum service.

2. Decreases air consumption from 10 to 20 percent as compared with iron nozzles.

3. Maintains stream contour and abrasive velocity.

NORTON COMPANY
WORCESTER 6, MASSACHUSETTS



Only the diamond is harder than Norbide

NORTON

Making better products to make other products better

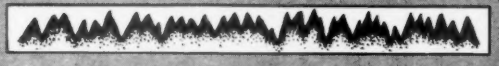
WHAT DO YOU SPEND ON CARBIDE TOOLS?

CUT YOUR COSTS BY INCREASING TOOL LIFE WITH PETER WOLTERS TOOL GRINDING AND LAPPING MACHINE

Sharpening on Peter Wolters ST 2 is simple enough to be handled by unskilled operators.

The entire cutting edge of a carbide tool can be lapped on this machine in one, rapid, accurate, pre-set operation, even if it includes planes of two different angles. Tool support and special swivelling device enable you to lap cutting edges and radius without unclamping the tool. Furthermore, no change of wheels is necessary between grinding and lapping. The outer of two concentric diamond wheels projects for rough grinding and a lever advances the inner wheel for finishing. Various tool holders are available for lapping a wide range of shapes. A centering microscope, of 20X magnification, can be used to pre-determine radius of the cutting tool and to examine the cutting edge.

Carbide cutting tools sharpened on ordinary grinding machines look like this under a microscope:



During machining operations, the peaks break quickly, the edge is dulled, and the tool must be resharpened or replaced. This means your cost and time loss is high — per production hour or per tool. However, tools ground and lapped with a Peter Wolters machine look like this:

The cutting edge is smooth, without unsupported, easily broken projections. Thus, these tools last longer and therefore cost you less in time and money. The Peter Wolters tool grinding and lapping machine can amortize itself in very short order and give you substantial net savings thereafter.

Get in touch with us and see how much time and money this unit can save in your plant. Write for bulletin or have our representative call on you.

COSA CORPORATION
405 Lexington Ave., New York 17

Tool source for all Precision Machine Tools — from Small Bench Lathes to Large Boring Mills

IN DETROIT AREA contact DETROIT-COSA CORPORATION, 16923 James Couzens Highway, Detroit 35, Mich.

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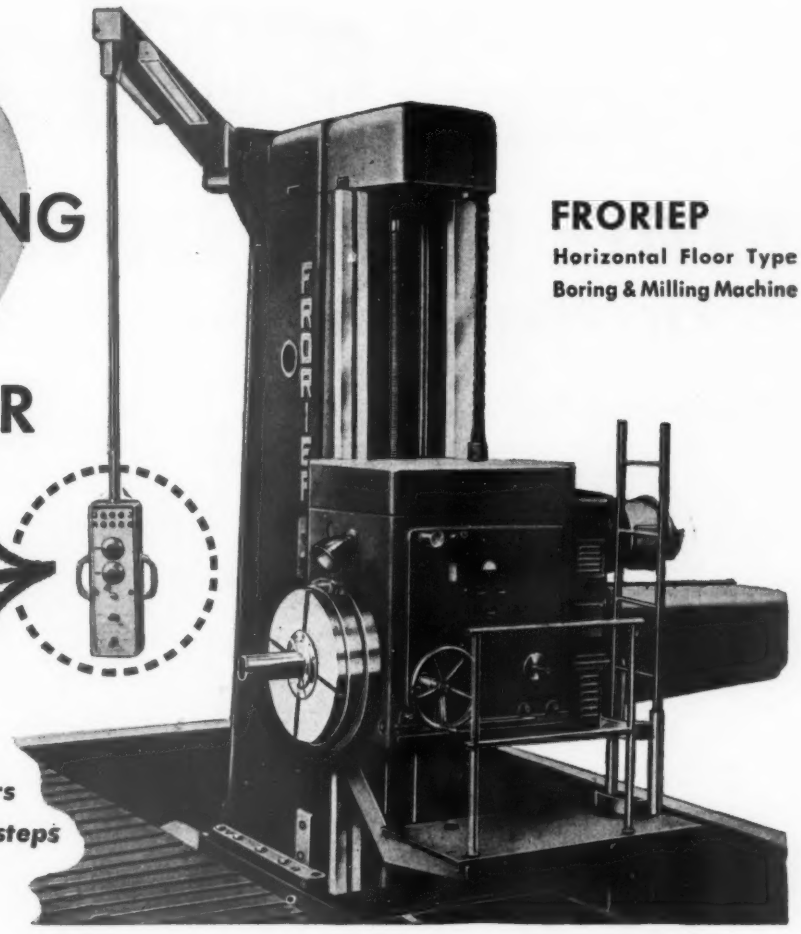
HEAVY BORING AND MILLING IS FASTER AND EASIER

this way



FRORIEP
Horizontal Floor Type Boring & Milling Machine

push button remote control eliminates operating levers . . . reduces time-wasting steps between workpiece and operating panel

- Automatic control of speeds, feeds, and movements.
- Optical settings of spindle in vertical and transverse position.
- Guides are automatically locked after each adjustment.
- Spindle and face plate can be operated either separately or simultaneously without special set-up or changes.
- Sturdy, extendible, carrier sleeve supports spindle close to workpiece.
- High cutting capacity with high speed and carbide cutters.
- Thread cutting can be handled easily, without special changes.
- Large boring capacity—four different models with spindle diameters of 5", 6¼", 7½" and 9" respectively.

Perhaps a Froriep machine is what's needed to improve your operation. We will be happy to send more information, or have one of our representatives call on you, if you wish.

COSA CORPORATION
405 Lexington Ave., New York 17

Your source for all Precision Machine Tools—from Small Bench Lathes to Large Boring Mills

IN DETROIT AREA contact DETROIT-COSA CORPORATION, 16923 James Couzens Highway, Detroit 35, Mich.

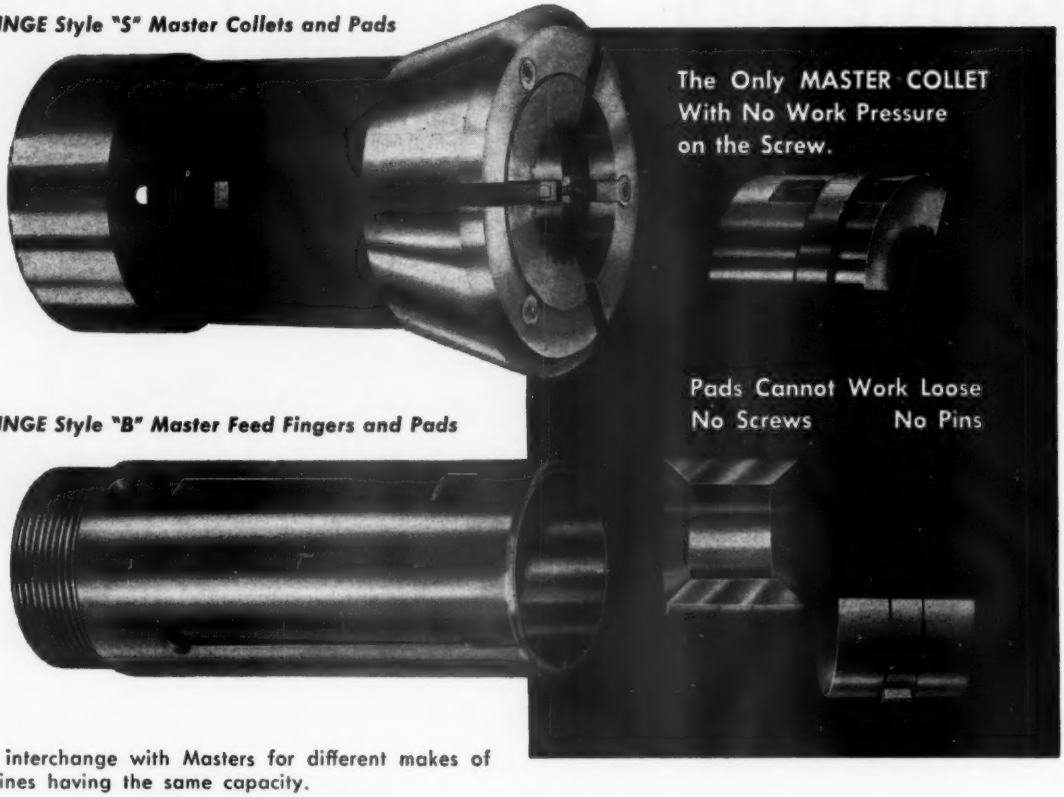
SEE ADVERTISERS INDEX, BACK OF BOOK, FOR INFORM-A-GRAM KEY NUMBERS

HARDINGE
ELMIRA, N.Y.

MASTER COLLETS AND FEED FINGERS

For Progressive Screw Machine Plants

HARDINGE Style "S" Master Collets and Pads



HARDINGE Style "B" Master Feed Fingers and Pads

Pads interchange with Masters for different makes of machines having the same capacity.

Write for descriptive Bulletins.

HARDINGE Master Feed Fingers with Adjustable Tension - provide tension change to suit varying requirements.

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

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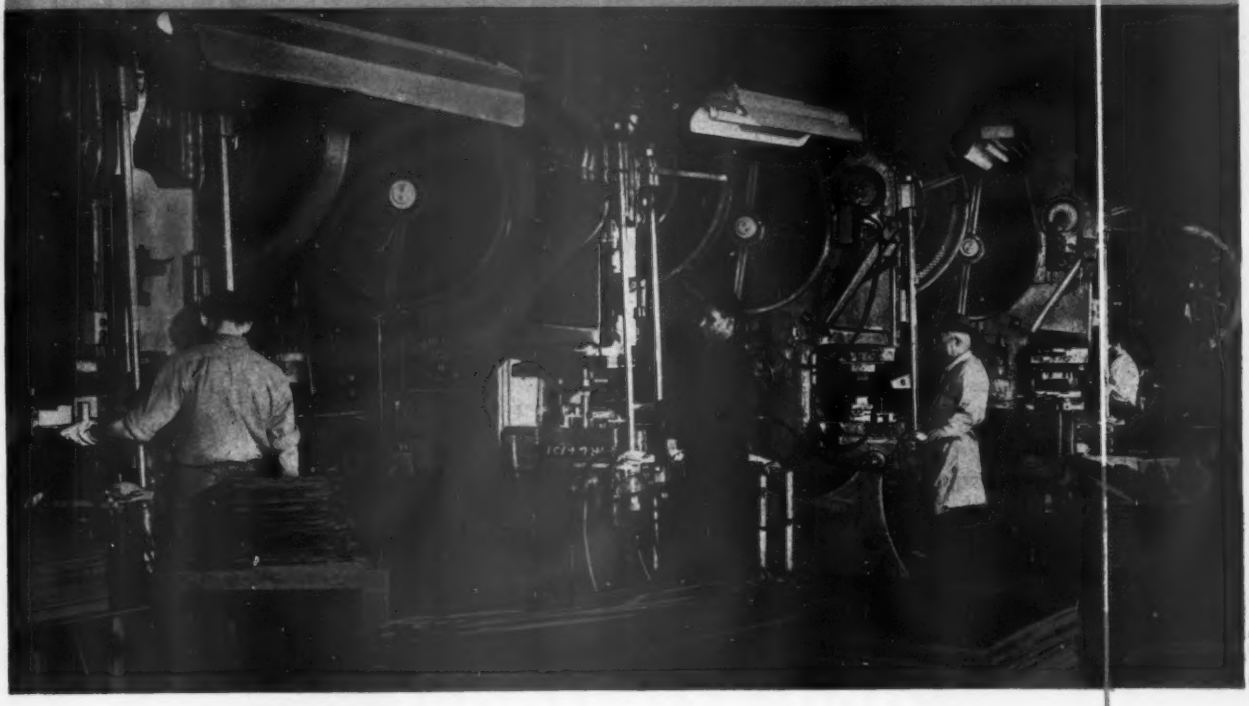
At Art Steel Company, too,

BLISS Presses Predominate



97% are Bliss-Built

Now, Art Steel Company, one of the leading manufacturers of steel office equipment — *Steelmaster* — credits Bliss with an important role in its progress. For Art Steel has looked to Bliss since 1923 for engineering counsel and the right press for each operation. Seventy-three Bliss presses making up 97% of Art Steel's press equipment attest to the fact that Bliss has justified this confidence.

Asked *why the continued preference for Bliss presses,* Art Steel officials sum it up in one word — *"dependability".*

And that's why hundreds of sheet metal plants throughout this country and abroad specify Bliss presses more than any others. Whether your requirements involve mechanical or hydraulic presses . . . high speed or normal speed . . . straight side or gap frame . . . it pays to call for a Bliss engineer. He can show you why Bliss belongs in *your* press room, too.

E. W. BLISS COMPANY, CANTON, OHIO
E. W. Bliss (England) Ltd., Derby, England
E. W. Bliss Company (Paris), St. Ouen sur Seine, France

U. S. Plants in Canton, Salem and Toledo, Ohio; and Hastings, Michigan. Branch offices in Chicago, Cleveland, Dayton, Detroit, Indianapolis, New Haven, New York, Philadelphia, Rochester, Toledo; and Toronto, Canada. West Coast Representatives: Moore Machinery Co., Los Angles and San Francisco; Star Machinery Company, Seattle. Other representatives throughout the world.

• • •

BLISS on your press is more than a name ...it's a guarantee!

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR INFORM-A-GRAM KEY NUMBERS

Standard Webber Accessories
for Dimensions under 12"

WEBBER Standard Accessories are designed for use with standard Webber Gage Blocks and are recommended for measurement under 12". Gage block holders, jaws, center point, scriber and base can be combined into a variety of small gages for precision layout and inspection.

Heavy Duty Blocks and Accessories
for Dimensions over 12"

No workpiece too large, infinite range. Patented clamps, jaws, center point, scriber and base offer wide gaging application. Patented eccentric clamp squeezes blocks in opposite directions thus maintaining ± .000005" over entire buildup.

Webber
GAGE BLOCKS and ACCESSORIES

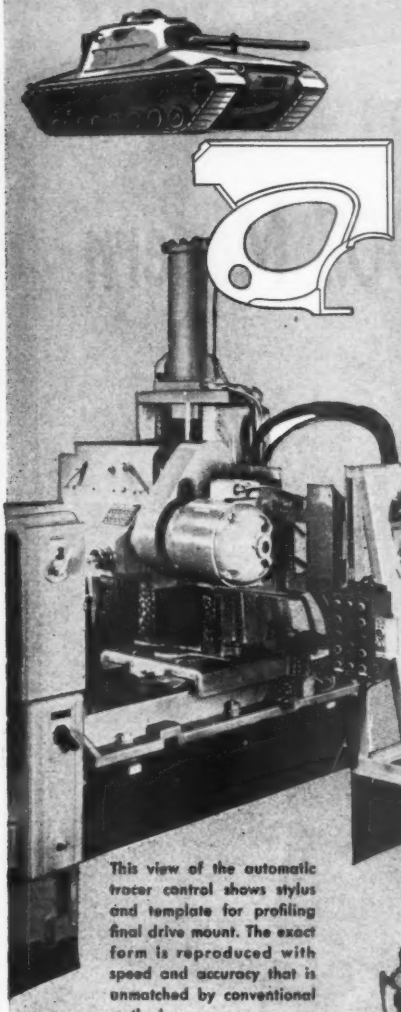
THE WEBBER GAGE COMPANY
12903 **Triskett Road** • **Cleveland 11, Ohio**

Largest exclusive manufacturer of precision gage blocks

Turchan and FORNEY

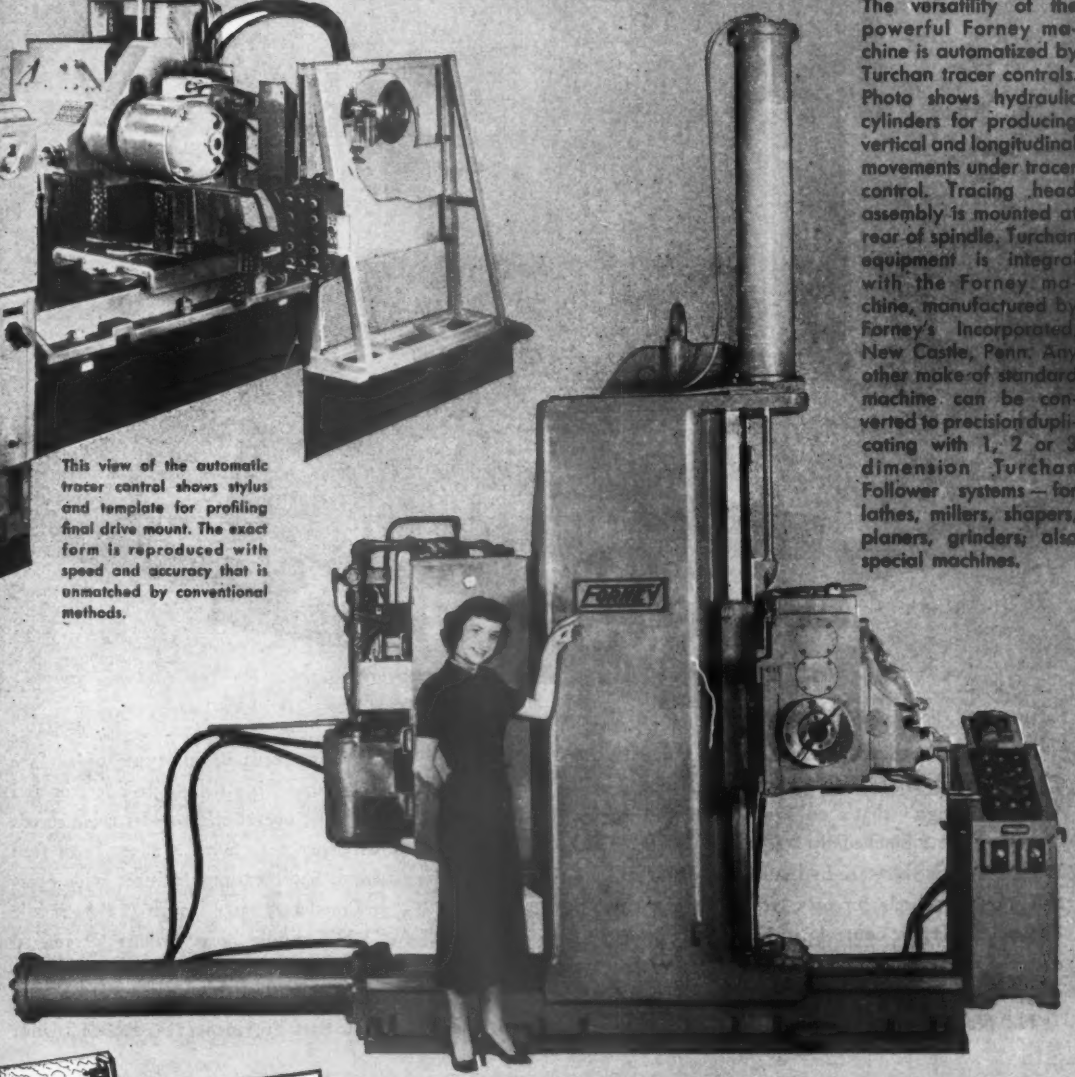
combine skills to simplify machining of intricate final drive mount for the M-48

Improved, simplified machining of this irregular part from armor plate casting is accomplished, in several plants, with the aid of Turchan Followers. For example, the Forney Horizontal Boring and Facing Machine, equipped with a 2-dimension Turchan Hydraulic duplicating attachment, makes easy work of profiling and boring the various openings in this final drive mount. Turchan method of tracer-controlled duplicating saves up to 60% in time.



This view of the automatic tracer control shows stylus and template for profiling final drive mount. The exact form is reproduced with speed and accuracy that is unmatched by conventional methods.

The versatility of the powerful Forney machine is automatized by Turchan tracer controls. Photo shows hydraulic cylinders for producing vertical and longitudinal movements under tracer control. Tracing head assembly is mounted at rear of spindle. Turchan equipment is integral with the Forney machine, manufactured by Forney's Incorporated, New Castle, Penn. Any other make of standard machine can be converted to precision duplicating with 1, 2 or 3 dimension Turchan Follower systems — for lathes, millers, shapers, planers, grinders; also special machines.



Write for Bulletin
Gives full information on the many advantages of Turchan automatic tracer-controlled duplicating.

Do you have a machining problem? Send specifications of job. Give make and model of machine. We'll show you how to produce it better, faster, at lower cost.

Turchan FOLLOWER MACHINE COMPANY
8259 LIVERNOIS AVENUE . . . DETROIT 4, MICHIGAN

Beautifully modern yet accessible — that's the No. 1218 Hydrabrasive! There's none of the so-called "modern design" that's only window dressing, with operating parts blocked by streamline covers. On the No. 1218 notice how the hydraulic pump and tank unit rolls out on wheels for easy servicing. Also note the convenient electric control panel that fully meets J.I.C. codes. These are only two examples of Abrasive unit design that means complete accessibility.

The No. 1218 is built for today's high production grinding schedules. It speeds up all types of surface grinding, and its accuracy is a delight to operator and owner alike. Hydraulic operation provides table speeds from 1/2 to 90 ft. per min., with 3/8" of cross feed in 1/5 of a second. Specifications include: wide cross travel (12") and moderate table length (18"); saddle ball ways; and 3 HP spindle motor driving a standard 12" wheel. Write for latest complete catalog describing No. 1218 Hydrabrasive. Abrasive Machine Tool Co., 16 Dunellen Road, East Providence 14, Rhode Island.

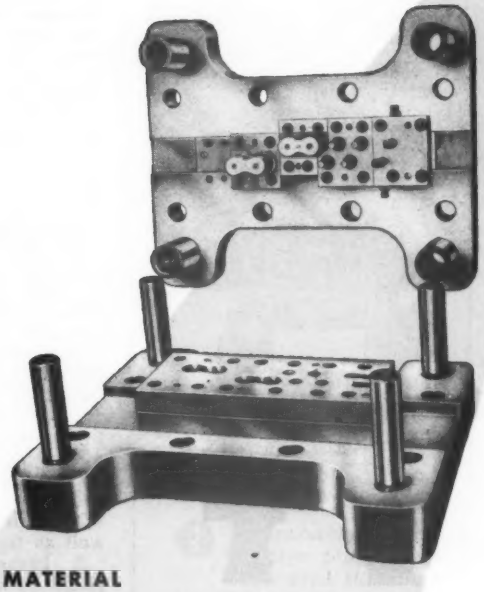
ABRASIVE
ACCURACY BOOSTS PRODUCTION

Abrasive Quality is Reflected in the Finish of Your Product

FOR PRODUCT INFORMATION USE CONVENIENT INFORM-A-GRAM CARD

WHITNEY CHAIN

links up with... PRODUCTO DIE SETS



MATERIAL

¼" SAE 3140 hot rolled steel in coiled stock.

OPERATIONS

Station No. 1 — Whitney Chain markings clearly embossed on each link.

Station No. 2 — Four holes, two to a link, rough pierced.

Station No. 3 — Two chain links blanked out on each press stroke.

TOLERANCES

Hole diameter + .0005" — .0005"
Hole centers + .001" — .001"
Link Contour + .005" — .010"
Die Set face parallel to feed slot + .002" — .002"

PRODUCTION RATE

153,000 links blanked per 40 hour week.
Between grinds, 75,000 pieces.

NEED PROMPT SERVICE?
CALL YOUR NEAREST
PRODUCTO ASSEMBLY BRANCH

Tough, ¼ inch-thick hot rolled steel chain links are not an easy stamping job . . . especially when heavy production must be matched with close tolerances and excellent finish.

Here are the figures as this job rolls along at Whitney Chain on Niagara presses equipped with PRODUCTO 4-pin progressive die sets. It's typical of the way Producto Service teams up to set production records.

THE PRODUCTO MACHINE COMPANY
970 Housatonic Ave., Bridgeport 1, Connecticut

For Precision Die Sets *Fast* Call . . .

PRODUCTO

ALSO MAKERS OF TOOL AND DIEMAKERS ACCESSORIES, VISES, MACHINERY

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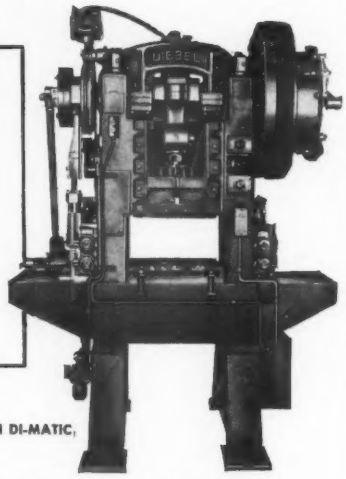
DIEBEL PRESSES

Built Like
Precision Dies

Question

can you L-E-N-G-T-H-E-N your DIE life?...



40-TON DI-MATIC

Answer

Definitely yes—if you employ your dies in a press engineered with the dies in mind, a press designed to assure positive punch and die alignment, no press deflections, and negligible vibration and shock.

The life of any die—the quantity of stampings obtainable—is limited by a definite number of sharpenings. Increasing the number of stampings between grinds is the *only* way to lengthen die life.

The Diebel 40-ton DI-MATIC Press prolongs die life because of die conscious press engineering

- Cylindrically Shaped Ram, Precision Ground — guarantees perfect alignment of punch and die
- Crankshaft Supported by Four Bronze Bearings — assures greater press rigidity
- Keyed and Tie-Rod Frame Construction — eliminates press deflections
- Built-in Shock Absorbers — minimize vibration and die shock

also 5-TON 8-TON 12-TON DI-MASTER PRESSES

Investigate

DIEBEL

Precision-Built Automatic

PRESSES

Write for catalog

Di Machine Corporation 2708 W. IRVING PARK ROAD CHICAGO 18, ILLINOIS

. . . **Automatic Factory, from page 8**

or more, many hundreds of machines, and with many different parts to be produced.

The extent of automatic handling (or automation as we prefer to call it) in our plants today was largely determined by engineering studies based on our experience and the experience of the machinery industry in general. These, coupled with an economic analysis, determined how far it was practical to extend automatic handling operations.

In order that a clear understanding of the problems involved may be obtained, the following principal subjects will be discussed today.

1. Transfer type machinery built with automation in mind. The transfer type machine combines similar operations to be performed on a part into one continuous machine with automatic indexing between work stations.

2. "Automation" which is a a coined word meaning the automatic handling of parts between progressive production processes. It is a separate and distinct phase of manufacturing engineering which coordinates the efforts of various departments in our plants, and of the machinery and equipment manufacturers, so that many of our departments can become, in effect, one large transfer type machine with facilities to handle the parts as well as the scrap generated.

3. Preventive maintenance programs to keep our production lines in operation including tool changing and the standardization program which is so important in a modern plant.

4. A reorganization and reallocation of work tasks and manpower to place a greater emphasis on brain power instead of muscle power.

5. Alert management to coordinate and get the best out of each of our technical skills.

Transfer Type Machinery

For our production lines of a few years ago, processing of parts was based on a series of individual machine tools to perform the operations in small increments with manual handling between each machine. Processing today must be based on the combination of similar operations into an integrated machine tool of many stations with automatic transfers between.

To illustrate the techniques used, we can consider the production of automotive crankshafts. One portion of our machining process involved the drilling of six oil holes, six metering holes, six lightening holes, and inspection of the operation. Ten years ago 29 seperate machines would have been required, while today the same department would require only three transfer type machines of eight stations each. The part would be loaded at one end and unloaded at the other end,

with all operations in between being completely automatic.

This combination of operations describes the machine tool which is known as the Transfer Machine. We can readily see that combinations of this type cause profound changes on our entire production process. Our manpower must be redistributed to handle the problems which arise. We must take a fresh look at our methods of maintaining machinery elements and in applying our tools to the job. Production lines in many cases are made up with groups of transfer machines that are completely automatic in themselves. These in turn must be coupled together in an economical fashion if we are to gain the full benefits of the transfer machine.

Automation

While similar operations are combined, there is a problem still remaining of connecting these new machines so that manual handling operations between the products of the various machinery builders will not be necessary.

It is up to us to see that all of the engineering groups involved are properly coordinated so that our automation devices can be designed with the necessary elements such as simplicity, ease of maintenance, and use of standard design details for the various sections necessary for a complete department.

The automobile industry as we know it today was successful because of the mass production techniques which made it possible to increase volume to such a point that the cost of a unit was within the reach of the average person.

The original chassis assembly line was utilized when Henry Ford introduced the idea of rolling the chassis along a route with operators and stock spaced along it. From this point, the moving chain conveyor developed and the operator was free to spend all of his time on assembly operations. The conveyor became a symbol of mass production, and conveyors were installed to perform many operations.

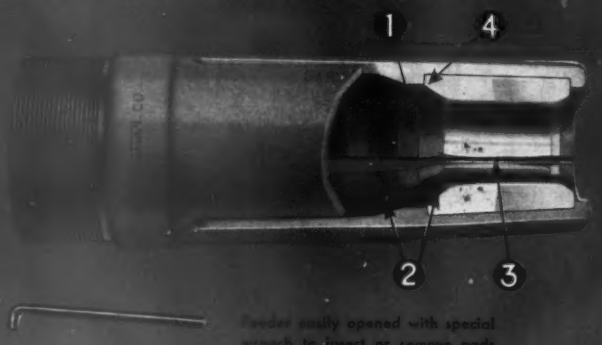
To meet changes in styling, facilities were rearranged to use as much as possible the existing facilities without major tear up. This approach to the problem was satisfactory until, in very recent years, it became apparent that the products had changed so radically that major changes were required in our planning of production processes.

The early automation programs were centered about rearrangment of standard and existing machines to connect them with mechanical devices which would eliminate the inherent delay caused by manual handling. Our new programs are based on the wide introduction of machinery and equipment that have

. . . Continued on page 96

SUTTON STYLE "L" MASTER FEEDERS

lower production costs



Feeder easily opened with special wrench to insert or remove pads

1. Slot in master engages lug on one of the pads, preventing pads from rotating.
2. Tapers on pads and in master give proper lead and allow stock to enter easily.
3. Double angle on side of pad permits worn pad to be restored to gripping size.
4. Recess in master that receives pads and takes operating thrust. No screws or pins to vibrate loose.

NO PINS OR SCREWS

No pins or screws are necessary to hold the feeder pads in place. The pads are seated in a recess in the master and a lug on one of the pads engages a slot in the master and keeps the pads from rotating as shown in the cross section view.

COMPENSATION FOR WEAR

Each pad is made with a double angle on each side. Hole size of the pad can be restored by grinding down the points of the angles, allowing tension to bring the pad sections together. This reconditioning can be done many times.

SELECTIVE HEAT TREATMENT

The conventional solid feeder must be subjected to three different heat treatments within a length of 4 to 6 inches. This difficulty is overcome in the Style "L" by making the master separately from the gripping pads, which are made from steel selected for wear-resistance.

ONE MASTER PER SPINDLE

Style "L" Masters handle a range of stock practically up to machine capacity. One master and different sets of pads will take care of the full range of one machine. When pads are worn out, it is necessary to purchase only new pads for use in the original master.

Department TP-1, Sutton Tool Company, Sturgis, Michigan

SUTTON COLLETS

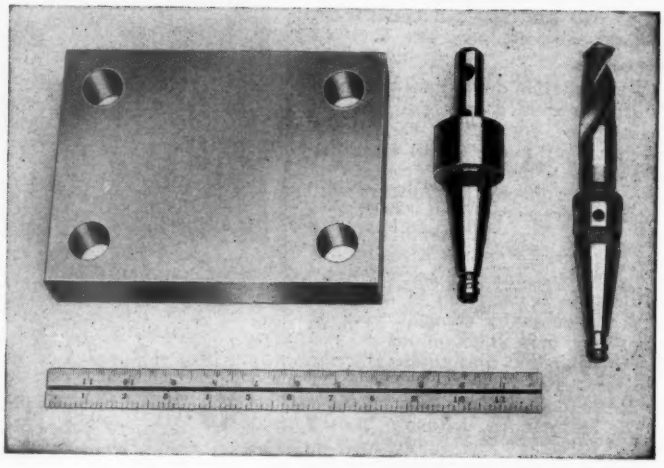
MOORE SPECIAL TOOL COMPANY

Hole Location Practices

Published in the interests of greater accuracy and quality in the toolroom and on the production line by the Moore Special Tool Company, Inc., 726 Union Avenue, Bridgeport 7, Conn., builders of Jig Borers, Jig Grinders, Panto-Crush Wheel Dressers, Die Flippers, Motorized Centers and a complete line of Hole Location Accessories.

4 HOLES to ±.0002" in 8 MINUTES

How would you do it?



The only tools used to complete this Jig Borer production job were the drill and carbide bit. The carbide bit will hold size for four holes. The last hole is measured and the tool bit set for the next piece.

Sixteen of these pieces were needed. The four 1" holes are 1⅝" deep—with location and size tolerances ±.0002". It would be impossible to obtain such accuracy using a drill jig—and impractical on this short run. Then how could you locate, drill, bore and check the four holes in only 8 minutes?

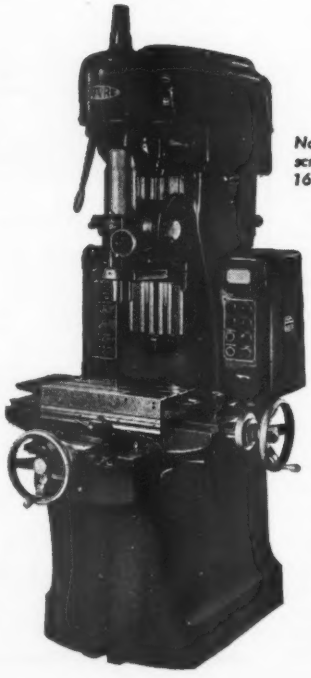
HERE'S HOW:

Using a No. 2 Moore Jig Borer with one 31/32" drill and one cut carbide bit, all sixteen pieces (64 holes) were finished in 2 hours and 38 minutes!

FIVE SIMPLE STEPS:

1. Load piece (no fixture needed)	30 sec.
2. Locate and drill 4 holes with 31/32" drill at 800 RPM	240 sec.
3. Bore holes with carbide bit at 1600 RPM	120 sec.
4. Check last hole and reset bit for next piece	60 sec.
5. Unload	30 sec.
Total time per piece	480 sec. or 8 min.
Total for 16 pieces (including 30 min. set-up time)	2 hrs. 38 min.

Why make a costly drill jig for those short production runs—or worry about keeping work within close tolerances? The Moore Jig Borer is a necessity in the toolroom; let it help you on tough production jobs, too. We have case histories which we will be glad to send you. Write today.



No. 2 Moore Jig Borer has lead screws accurate to 0.0002" in 16" of travel

see our catalog in

MACHINE TOOL CATALOGS

or write for copy

DIECO alone OFFERS YOU PROOF OF PLUS-PERFORMANCE

"DIECO Die Springs outperform others 3 to 1 and better!", says industry.

". . our die spring purchases reduced 70%, and maintenance costs down 75% on 2 refrigerator liner dies. Also 16-hr production bonus per week!", claims a leading refrigerator manufacturer.

". . . reduced thickness of our die sets due entirely to 'greater travel' of DIECO Die Springs!", says famous appliance manufacturer.

". . no more troubles since we switched to DIECO Die Springs and Application Service!", states major automobile manufacturer.

DIE-CO
Springs
The answer to your die spring problems!
Here's why DIE-CO Die Springs are capable of outperforming others 3 to 1 and better.
THE DIE SUPPLY COMPANY
GENERAL OFFICES
1400 BROOKPARK ROAD • CLEVELAND 9, OHIO
BULLETIN 1953
DIE-CO

INDUSTRY DEMANDS DIECO DIE SPRINGS BECAUSE . . .

DIECO Die Springs guarantee **proven** increases in production, less down-time, lower maintenance expense and bigger savings in total die spring purchase cost. Learn why DIECO Die Springs are **better.** Investigate DIECO's Die Spring Application Service backed by **20 years field experience.** See DIECO's handy price list of nearly **500 stock sizes.**

Get the facts . . . send for your DIECO Spring Catalog NOW

The DIE SUPPLY Co.

ST. LOUIS 13: Scott Special Tools, Inc., 1252 N. Kingshighway ★ FOrest 3454
CLEVELAND 9: 1400 Brookpark Rd. ★ SHadyside 1-9000 ★ TWX-CV-202
PITTSBURGH 6: 122 S. Sheridan Ave. ★ EMerson 1-0440
DAYTON 4: The Die Supply Sales Co., 311 Vermont Ave. ★ MI. 9691 ★ TWX-DY-85
BUFFALO 1: Die Supply Corporation, 234 Carolina St. ★ MAdison 1964

The Die Supply Co., 1400 Brookpark Rd., Cleveland, O.
Please send me DIECO Spring Catalog 1953-T at no cost or obligation to me.

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Company .....
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City ..... State .....

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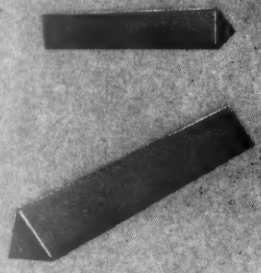
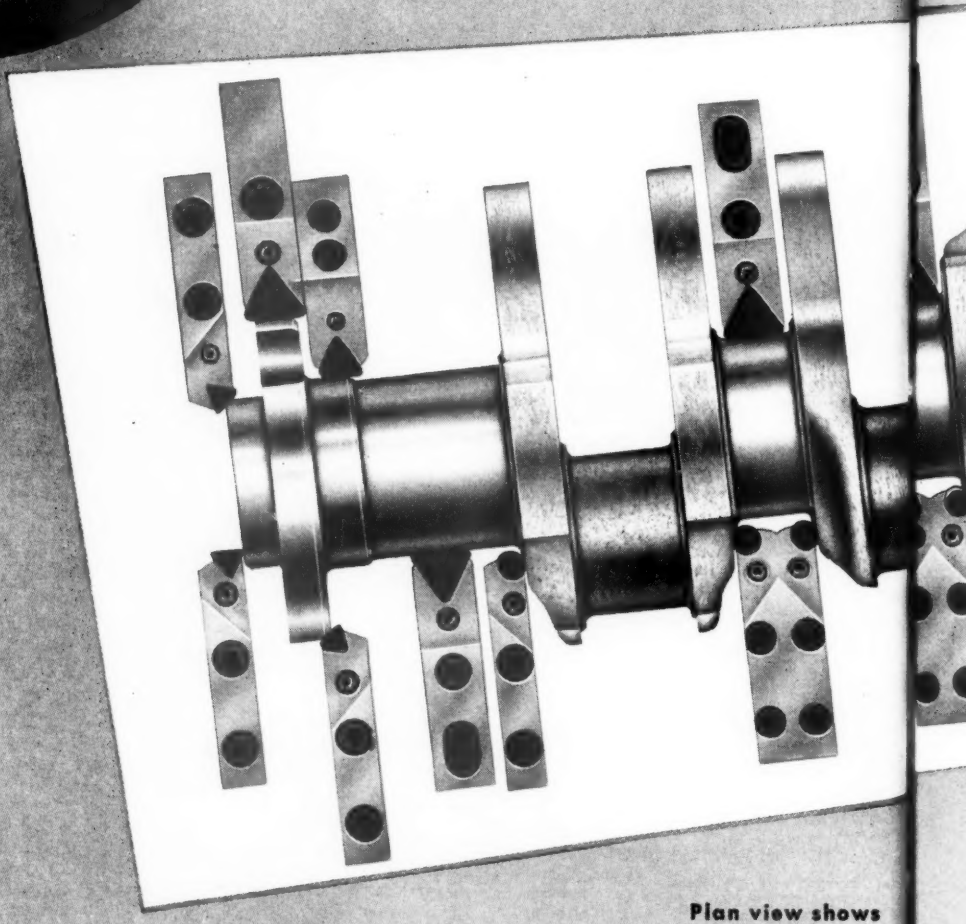
WESSONMETAL
TUNGSTEN-CARBIDE

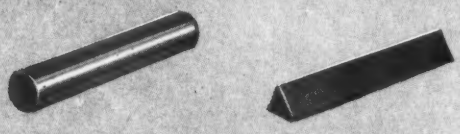
WESSON TOOL HOLDERS

First.





Wessonmetal—the cemented carbide giving users phenomenal performance throughout industry—turns to new successes on this difficult crankshaft turning job. Look at the production increase, the increase in pieces per tool change, the long, more efficient tool life possible with Wessonmetal.



Plan view shows position of front and rear tools only.

WESSONMETAL

WESSON METAL CORPORATION
LEXINGTON 34, KENTUCKY

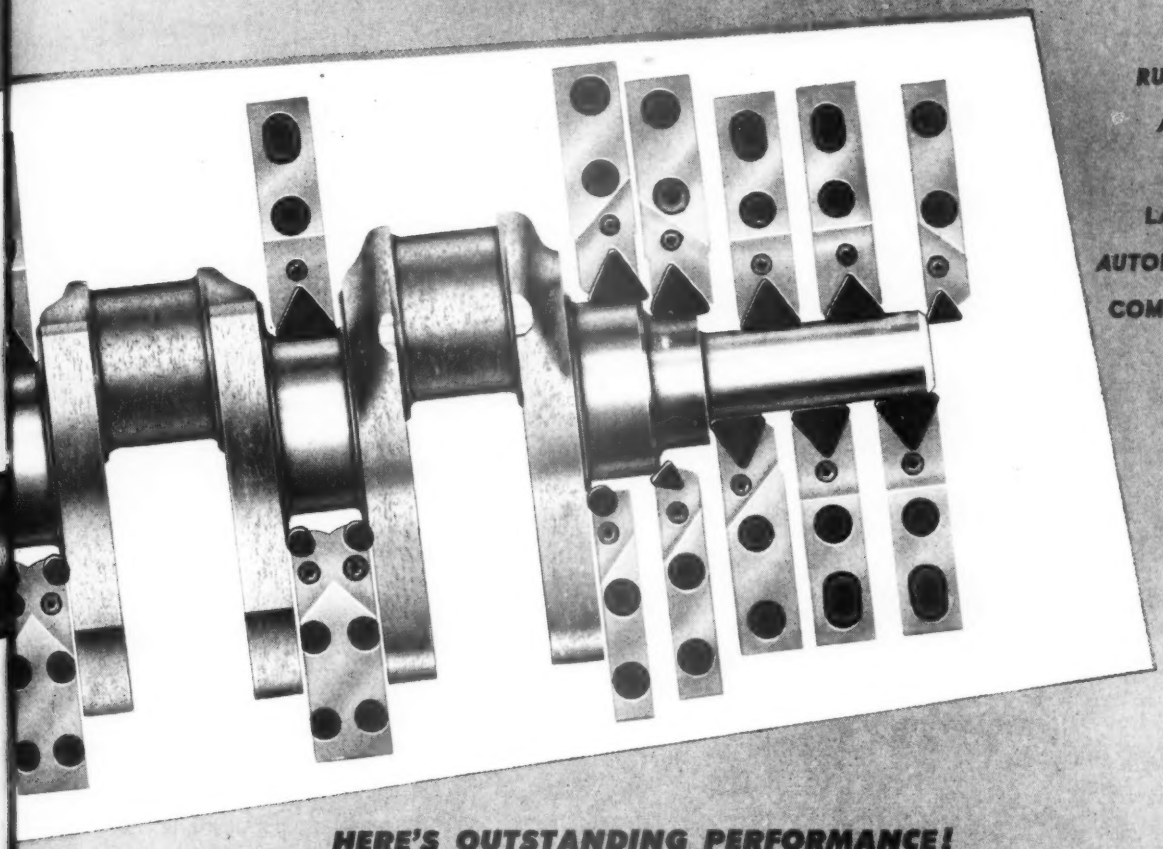
.TO TURN CRANKSHAFTS

with CARBIDE INSERT TYPE TOOLS

USING WESSON BAND TYPE TOOL HOLDERS

and WESSONMETAL SOLID CARBIDE INSERTS

ON LeBLOND AND WICKES LATHES



NOW RUNNING AT ONE OF THE LARGEST AUTOMOTIVE COMPANIES

HERE'S OUTSTANDING PERFORMANCE!

AN AVERAGE OF 9000 PIECES PER INSERT BEFORE SHARPENING

OLD METHOD	
Pieces	11 per hour
Cycle Time	1 min. 55 seconds
Cranks per tool change (average)	1.7 pieces

NEW WESSON METHOD	
Pieces	48 pieces per hour
Cycle Time	40 seconds
Cranks per tool change (average)	1500 pieces

OUR 30TH YEAR IN CARBIDE!

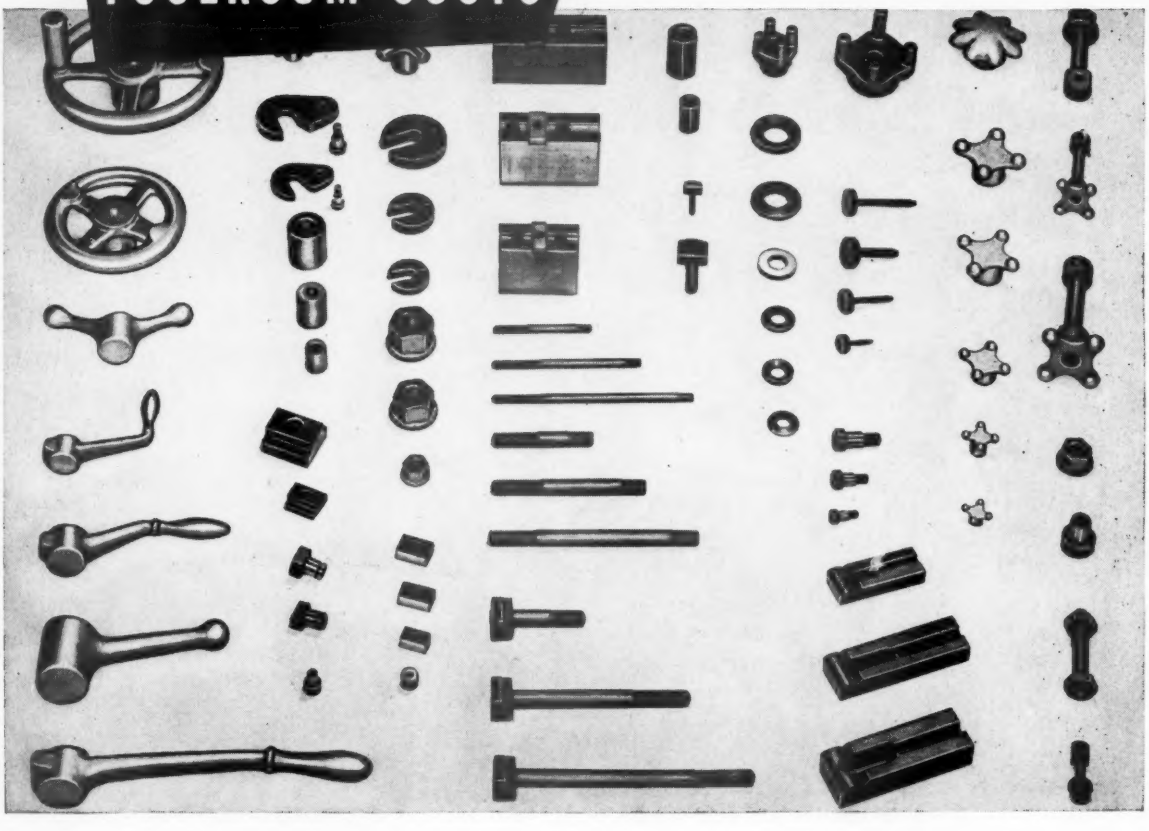
WESSON COMPANY

1220 WOODWARD HEIGHTS BLVD. • FERNDALE (DETROIT 20), MICH.

WRITE FOR *Complete Story* with DRAWINGS

CUT DESIGN AND TOOLROOM COSTS

SAVE ⅓ OR MORE ON JIG and FIXTURE PARTS



BLANK JAWS
SINE FIXTURE KEYS
SHOULDER SCREWS
MALLEABLE HANDLES
TEE SLOT BOLTS
THUMB SCREWS
TEE SLOT NUTS
HAND WHEELS
REST BUTTONS
FIXTURE KEYS
HAND KNOBS
C-WASHERS
STUDS, ETC.

SPECIFY THE LINE THAT SAVES YOU TIME!

Use Jergens mass-produced components as standard in your plant. Realize big savings in design, tool room and production facilities. Jergens makes over 400 precision parts designed to save your time and money—standards that will hold up in the toughest applications usually outlasting the jigs and fixtures on which they are used.

Write For Your Copy of Jergens' New Folder

Jergens BETTER TOOLS AT LOWER COST

TOOL SPECIALTY CO.
Dept. TP-5 712 E. 163rd St.
Cleveland 10, Ohio

gleanings from an editor's travels

I used the occasion of an editors' preview of Norton Company's magnificent new grinding machine plant in Worcester, Mass., to visit several other New England manufacturers.

The signs of optimism concerning continued high levels of production and sales were many. Order backlogs are healthy and, in many instances, plant employment rolls are at their postwar high. Coupled with this, the increases in production costs are more than being talked about. They are being battled with all the tooling ingenuity that can be mustered.

I was favored by being shown wooden mock-ups and experimental models of machine tools yet to be announced. The advent of these machines will further substantiate our realistic transition from a sellers' market to a buyers' market. Although progressive management is all ears to new machines and new methods which both will cut costs and increase productivity, new equipment will have to be sold on the basis of performance, not just availability.

The new Norton grinding machine plant is a $6,000,000 package of today's most advanced managerial thinking and planning, plus action. Its many features include straightline production methods, new modern machine tools, special materials handling equipment, air-recirculating dust control, forced ventilation providing three complete air changes per hour, and a wonderfully high level of illumination throughout.

It was interesting to learn of the reasons that led Norton to locate their new plant in Worcester, which is several hundred miles from the center of their domestic market. These included such factors as the friendly relations they have enjoyed with their employees since 1900 when the first Norton machine was built, and the unusually high proportion of their people who have been with them for 25 or more years. Then there was the consideration that the highly skilled machine tool operators, assemblers, and inspectors, so essential to the production of precision grinding machines, were already available in their current working force. Further, because grinding machines are of high value, the freight from New England to the Middle West is a relatively small factor in the delivered cost.

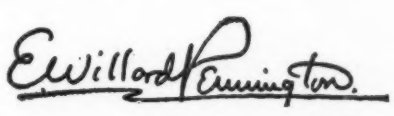
Everett M. Hicks, Vice President and Manager, Norton Company Grinding Machine Division, said, "There has been much talk about the flight of industry from New England to other areas, but in our opinion machine tools and other products requiring high skill in their manufacture are the type of goods which can be produced advantageously in this area. For all of these reasons, then, we decided to expand our plant here in Worcester".

Speaking of some of the new machines forthcoming from the new Norton plant, Robert D. Lawson, Sales Manager, made a very significant and prophetic statement in that "There is no doubt about the necessity of automation in any post-defense machine tool selling plans if customers are to be sold the advisability of replacing existing productive equipment. Automation is the only present apparent way to give back to management the control of their production and for them to reduce costs to meet a strong competitive market".

A few days and a thousand miles later, I heard Tell Berna (Mr. Machine Tool) address the Westinghouse Electric Corporation's 17th Annual Machine Tool Electrification Forum. Recognizing the one question common to all manufacturers: How can we get our costs down?, he said "It is up to the machine tool builders to supply the answer to that question. This is an obligation that we have to our customers. It is also a responsibility which our industry owes to our country. Our standard of living is geared to productivity. **** Some of our customers may not yet realize the potentialities of this situation. Many of them think, no doubt, that they are well equipped with the machine tools bought for World War II. But do you realize that most of the World War II machine tools are now ten years old?

"There has accumulated in this country a tremendous pool of obsolete equipment. *** We must continue the program of product design and development. We must have ready for the market new models which will obviously demonstrate such a saving in production cost that their purchase will be imperative.

"The great danger to our country is obsolescence. The great strength of our country is productivity. It is the job of the machine tool builders to lessen that danger and to increase that strength."

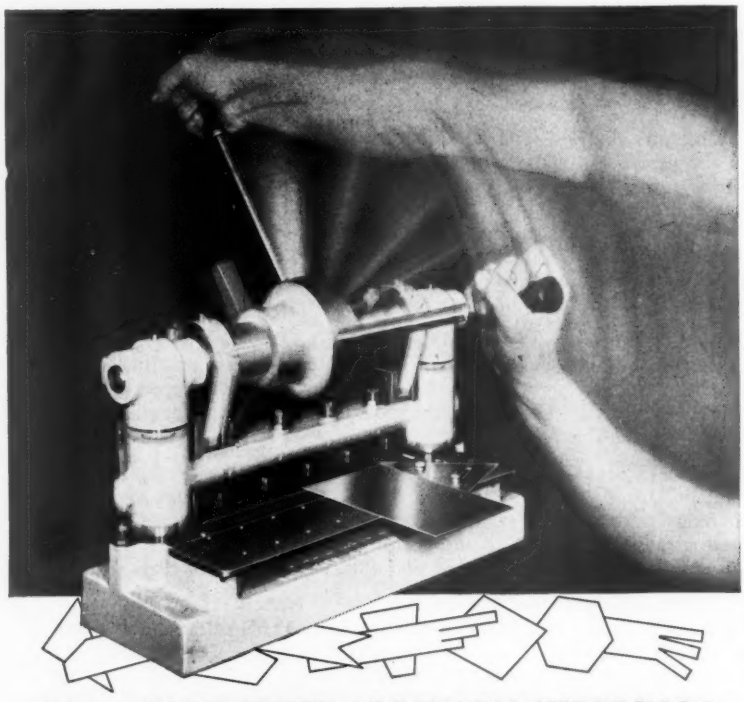


editor

Editorial Index

SOON TO APPEAR IN FUTURE ISSUES

Index Press Tooling • Quality Capability • Automatic Loaders for Crankshaft Lathes • Die Maintenance • Press Workability of Lurium • Do's and Don'ts for Press Brake Tools • Application of Telephone Equipment to Machine Tool Control • Production and Inspection Fixtures for Converter Parts • Abrasive Belt Grinding of Buckets and Blades • Blanking Die Designs and Applications • Inspection Set-



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- **PRECISION**—strips less than .025" wide accurately sheared and duplicated.
- **CUTTING SPEED**—rivals power machines.
- **RATED CAPACITY**—16 gauge steel.
- **EASY TO OPERATE**—a woman can operate it with minimum effort.
- **CHOICE OF MODELS**—available in four sizes. Widths from 6 to 24 inches. Four power models.
- **ENGINEERING SERVICE**—always available.
- **PORTABLE**—readily moved about.
- **RUGGED**—backed by year warranty.
- **DELIVERY**—immediate on most models.
- **COST**—that's good too.

*pronounced Die-ack-ro

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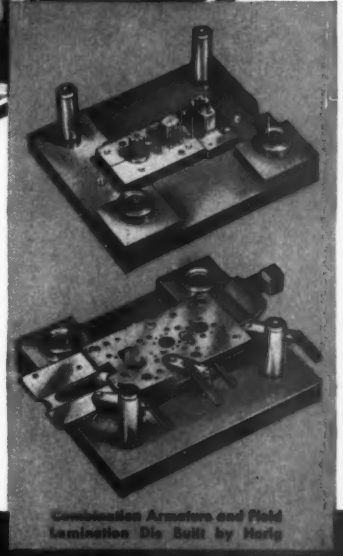

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MACHINING ON THE SINGLE SPINDLE AUTOMATIC

by Lester F. Spencer
Chief Metallurgist
LANDERS FRARY & CLARK
New Britain, Conn.

THE SINGLE SPINDLE AUTOMATIC SCREW MACHINE, as exemplified by the Brown & Sharpe No. OOG automatic illustrated in Figure 1, is one of the more frequently used types for the rapid machining of small parts. Although there are several models available, the operational procedures, which will be discussed in detail, are very similar. Thus, a bar of stock to be machined is held firmly in the spindle by a spring collet and rotated at constant speed, while the various cutting operations are performed by tools that are mounted either in the turret or on the cross slides. A friction clutch on the spindle permits reversal in the direction of the spindle rotation, or to instantly change the spindle speed. Such changes are used to suit the different tools employed in the cycle of operations.

There are two slide positions; each cross slide being advanced and withdrawn once, or as many times as the work requires, in the production of a machined piece. The turret, which has six tool positions, revolves in a vertical plane on the side of the turret slide. After each turret operation, the turret slide is withdrawn and the turret is indexed or rotated one-sixth of a turn, to bring a new tool into working position. This indexing is smooth and rapid, and when required, double indexing is possible when all the tool positions in the turret are not occupied. Usually, the last machining operation is that of cut-off, where the finished piece is severed from the bar. After this has been done, the collet, which firmly holds the bar stock in position for machining, opens automatically in conjunction with the operation of a feeding mechanism to permit the forward movement of another portion of the bar stock in to machining position. The collet closes and the machining operations specified for the specific part is repeated.

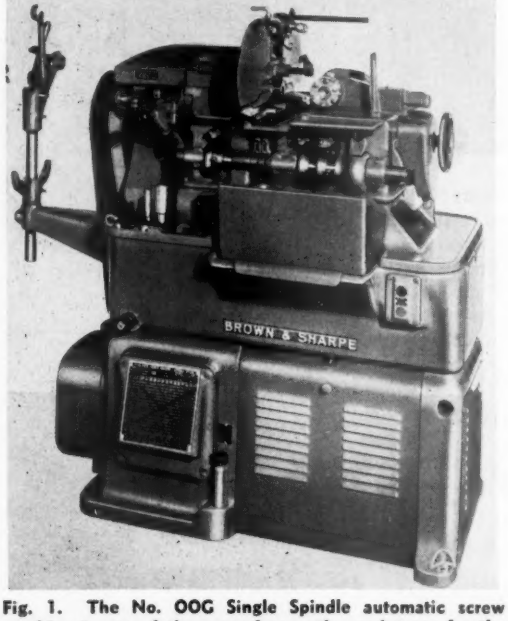


Fig. 1. The No. OOG Single Spindle automatic screw machine is one of the more frequently used types for the rapid machining of small parts.

The success of the single spindle automatic in producing work with a high degree of accuracy, good finish and at a rapid rate depends to a great extent on both the selection and setting of the tools to perform the various operations. A wide variety of tools can be employed as will be realized in the following discussion.

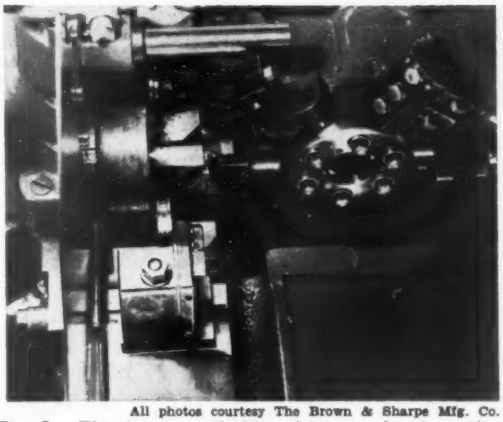
Turning Operations

The balanced turning tool, the box tool and both the plain hollow and adjustable hollow mills are the standard turning tools; all being fed to the work from the turret position. Both the knee tool and the swing tool are also employed; the former being used only for turning scale on black work. The swing tool is the only choice where taper turning is necessary in forming a section which does not permit the use of a circular form tool.

The balanced turning tool consists of two blades set to operate on opposite sides of the work. These blades are clamped securely in a box-like body, the shank of which is fastened in the hole of the turret. Since this tool is invariably used for heavy roughing cuts, a clearance of approximately 15° is employed so that each bit can be advanced into the work without rubbing on the surface below the cutting edge. Also, since the bit is tipped 15° by its position within the body of the tool, it will be necessary to grind a 30° hook to get a work or cutting rake of 15°. This cutting rake will vary in accordance to the material that is being cut.

Due to the comparative large body of this tool, sufficient time must be given to permit withdrawal of the tool after the working operation. Thus, this tool cannot be employed where it may be necessary to bring either one or both cross slides into position immediately after rough turning has been completed. Also, in turning long, slender pieces of small diameter, the plain hollow or the adjustable hollow mills are preferred due to the support that can be given to the work-piece. Chip control grooves are employed on balanced turning tool bits, however this will be more completely discussed under the discussion on box tools.

Both the plain hollow and the adjustable hollow mills can also be used as roughing tools. The plain hollow mill consists of a single piece of round hollow steel so that one end can serve as a shank while the other end has the cutting edges. This type of tool has three cutting teeth, resembling a clutch, which are ground with the proper clearances to give the desired cutting edges; the specific tooth design being dependent upon the material to be cut. For straight roughing a plain hollow mill is only second to a balanced turning tool, which has the advantage of adjustable blades while the plain hollow mill is for a single size only. As mentioned previously, the round hole extending through the center of the mill will serve to support long, slender pieces of small diameter after a balanced roughing cut has been made. However, greater care must be taken to check whether the plain hollow mill is cutting correctly to size since, due to the small clearances available between the diameter of the turned stock and the hole in the mill, difficulties such as 'seizing' and loading of the mill may occur.



All photos courtesy The Brown & Sharpe Mfg. Co.

Fig. 2. This is a view looking down on the six station turret with a balanced turning tool taking a cut.

The adjustable hollow mill is very similar to the balanced turning tool in that the two or three radial cutting blades are adjustable to cut a variety of sizes. In construction, this tool consists of a cylindrical body; one end of which is a shank which fits into the turret, while the other end has slots where-in the radial cutting edges are mounted. As in the plain hollow mill, this tool has a hole throughout the entire body. Both roughing and finishing cuts can be made with this tool; roughing operations requiring a three bladed tool, while a tool with two blades and two back rests are required for finishing. As with the balanced turning tool, sufficient time must be allowed for withdrawal of this tool from the revolving work. It has the same limitations where both or one cross slide follows immediately after roughing has been completed.

The box tool, of which there are a variety of designs, are usually considered as finishing tools. Regardless of design, the box tool consists of adjustable blades mounted in a box-like frame and set tangent to the diameter of the rotating work. The advantages in the use of a box tool can be summarized as:—(a) adjustment over a wide range of diameters; (b) two or three tools for turning different diameters, facing shoulders or pointing the work; and, (c) the support that can be given by the center hole within the shank of the tool for turning long, slender work.

The roller box tool is usually employed for heavy finishing cuts. The cutting blade is followed closely by two rolls which are mounted directly opposite the blade and about 1/64" behind the blade. The rolls bear on the diameter of the stock which has

been turned. The function of these rolls are: (a) to serve as back rests for the work and to prevent it from being pushed away or deflected by the cutting pressure of the tool; and, (b) to burnish the surface of the machined piece to obtain a smooth, bright finish.

In order to obtain free cutting and produce the required finish, the tools must be sharp with the proper rake and clearance angles in accordance to the specific type of material machined. In machining aluminum alloys, it has been stated[3] that surface finishes of better than five micro-inches have been obtained on diameters turned with a box tool, particularly when using roller type rests and tungsten carbide cutting blades. Fine finishes can also be obtained with the V type back rests in the machining of the aluminum alloys. Longer life will result if the rests are also made of tungsten carbide.

In utilizing the box tool, the clearance angle given by the tool when mounted in its holder is 8°. This value is usually satisfactory for the machining of most materials, and is indicated as angle 'E' in Figure 3. As is also indicated in Figure 3, the cutting point 'A' is set so that the diameter through the work at its point of contact is perpendicular to face 'F' of the blade. This applies in general to the setting of tools for roughing and finishing cuts on most metals. Angle 'B' will vary with the material to be cut. Thus, edge 'K' may be ground square with face 'F' in machining the aluminum base alloys, however a slight angle of rake 'B' may be employed. This edge should never be ground so that the angle between 'K' and 'F' is more than 90°. Face 'G' should be ground with sufficient angle of rake 'D' to give good chip shearing action.

Where it is required on either balanced turning or box tools, chip control grooves necessary to break up the chips can be placed on the tool bits; the hook rake angle and the land width being dependent upon such factors as material to be cut, depth of cut, feed employed, etc. In some instances, as in the machining of the free cutting aluminum alloy, 11S-T3 and the magnesium alloys, a chip control groove is not required. Where chip control grooves will aid in chip removal, full consideration to chip curler or chip breaker design should be made in accordance to the recommendations as given by the material vendors. This information can be used for basic designs, however modifications may be required in accordance to the requirements of a specific job. In general, the suggested observations as given below[2] may aid, thus:

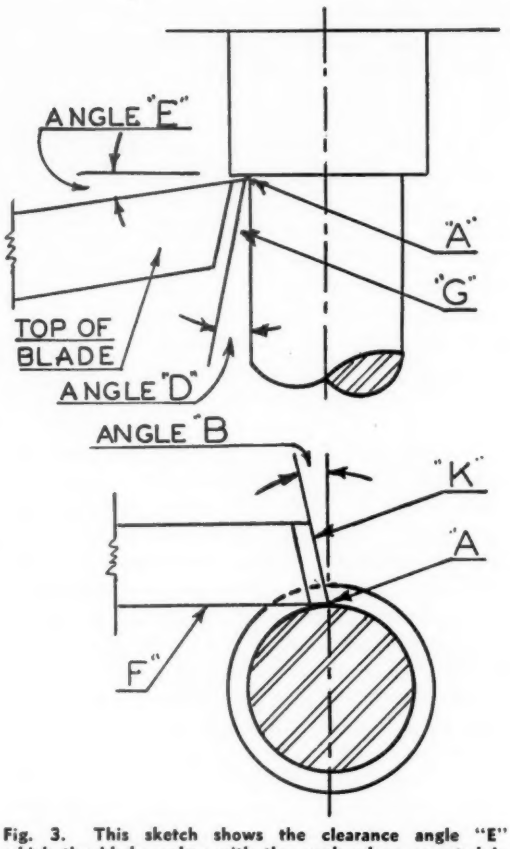


Fig. 3. This sketch shows the clearance angle "E" which the blade makes with the work when mounted in the holder. Angle "B" will vary with the material to be cut, and rake angle "D" should be sufficient to give good chip shearing action.

(a) A bit will have too little rake or hook if the tool seems to be laboring and the cutting oil is smoking. Insufficient rake will make it difficult to move the turret slide forward by hand, because the tool resists the feed and tries to push the stock ahead;

(b) A bit has too much rake if the cutting edges dull rapidly and has a tendency to chip or break down. Too much rake reduces the metal supporting the cutting edge and weakens the tool;

(c) Clearance angles can also be judged. Too little clearance will cause rub marks, whereas too much clearance may contribute to the break down of the cutting edge;

(d) Back rake pulls the chips away from the work axis. If the chip does not move out, then increase this angle.

Too great a back rake leaves the tool too pointed and without sufficient physical support.

Circular Forming and Cutting Off Tools

Both of these tools operate from the cross slide positions; the forming tool being used in shaping or turning part or all of the body of the piece, whereas the circular cut-off tool parts the finished machined piece from the bar. The circular form tool is made by machining the periphery of the tool in a lathe until the required shape is obtained; a deep groove being ground into the periphery to give the cutting edge. The advantage of form tools is that a large number of different diameters and shapes may be machined into the stock with one tool. Once made, the form tool is simple to grind and maintain.

The circular cut-off tool, which is similar in design to the circular form tool, is illustrated in Figure 4. A clearance angle of 23° is normally used; the outer-most point of the tool being placed on the side of the piece to be cut-off. Although the width of the cut off tool will control the number of items obtained from the bar, too thin a blade is not advised since it will not have sufficient rigidity and will tend to wander into the cut, leaving a wavy, unsquare surface. Recommended relationship between stock thickness and width of cut-off is given in Table I.

Circular tools are designed so that the cutting edge is below the center of the work and should be mounted so that the cutting edge is in line with the center of the work. The purpose of this relationship is to obtain a clearance angle between the work and surface of the tool just under the cutting edge; this clearance value usually being between 8° and 10°. Side clearances up to 3° may be employed depending upon the material to be cut; this being quite essential where deep form cuts are made. A clearance angle of 2° to 3° being suggested for the stainless steels. In the event that either aluminum, magnesium or the copper base alloys are to be machined, this side clearance value will vary from ½° to 1°.

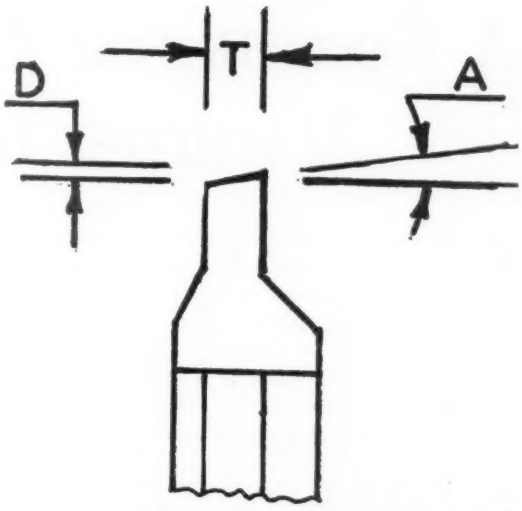


Fig. 4. A is 23° when cutting brass, aluminum, copper, silver and zinc. A is 15° when cutting steel, iron, bronze and nickel. Least thickness (T) used when cutting off into tapped holes is the lead of two and one-half threads plus 0.010". Least thickness (T) used when cutting off into reamed holes smaller than ⅛" in diameter is 0.040". Thickness used when cutting off tubing is two-thirds T as given below for corresponding diameters of stock. Thickness used when angles or radii start from outside diameter of tool is governed by varying conditions and determined accordingly.

In many instances, the cutting surface of a circular tool will have a slight rake which will aid in the cutting action and thereby reduce the force required to feed the tool into the cut. A horizontal cutting surface or zero top rake is usually employed for the free cutting yellow brass, however where the more difficult copper base alloys are machined, the top rake value may be as

. . . *Continued on page 54*

Table 1. Table of thicknesses for circular cut-off tools.

Diameter of Stock, inches	T, Thickness, inches	D, Depth of Cut, inches	
		for Brass	for Steel
1/16	0.020	0.0085	0.0055
3/32	0.030	0.013	0.008
1/8	0.040	0.017	0.011
3/16	0.050	0.0215	0.0135
1/4	0.060	0.0255	0.016
5/16	0.070	0.030	0.019
3/8	0.080	0.034	0.021
7/16	0.090	0.038	0.024
1/2 to 9/16	0.100	0.042	0.027
5/8 to 3/4	0.120	0.051	0.032
13/16 to 1.0	0.140	0.059	0.038
1 1/16 to 1 5/16	0.160	0.068	0.043
1 3/8 to 1 7/8	0.190	0.081	0.051
2.00 to 2 1/2	0.220	0.093	0.059

A Fixture for Eccentric Machining on Turret Lathes

by Michel J. Waltash
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Cleveland, Ohio

BODIES OF THE HYDRAULIC PUMPS manufactured by Pesco Products, Division Borg-Warner Corp., are designed so that the two cavities are eccentric to the center of the body. The cavities are of stepped diameters, and the larger diameters merge producing a shape as shown in Figure 1. The cross section portion of Figure 1 shows the positions of the large and small diameters of each cavity and the merging relationship of the large diameters.

Pesco Products builds hydraulic pumps in a large range of sizes. Some are turned from bar stock while the larger sizes are made from sand castings.

The body type shown in Figure 1 is used in high pressure service and is designed for 1500 psi. In the production of this particular type of body the first operation is performed on an automatic screw machine on which a blank is produced from bar stock with an "O" ring groove turned on the periphery.

The boring of the holes eccentric to the center of the part is performed on Warner & Swasey turret lathes equipped with indexing fixtures specially designed by Pesco engineers. Figure 1 shows the body as it appears when the turret lathe operations have been completed. Mounting holes are drilled in another operation and bore-matic operations complete the part by bringing all dimensions to the specified tolerances.

These specified tolerances are shown on two views in Figure 1 and are: diameters of both large and small bores, +.0005″; diameter of counterbore, ±.005″; body diameter +.001″; dimension from face of part to bottom of small bore, ±.005″; from face of the part to the bottom of large bore, ±.002″; center to center of the two cavities +.0005″; and an over-all length of body, ±.005″.

Indexing Fixture

The special indexing fixture developed for holding the pump bodies while performing the turret lathe operations is shown in Figures 2 and 3. Figure 2 shows a three dimension view of the fixture while Figure 3 shows an assembly layout.

When this indexing fixture was first developed the spindle center of the fixture and the center for the workpiece were fixed.

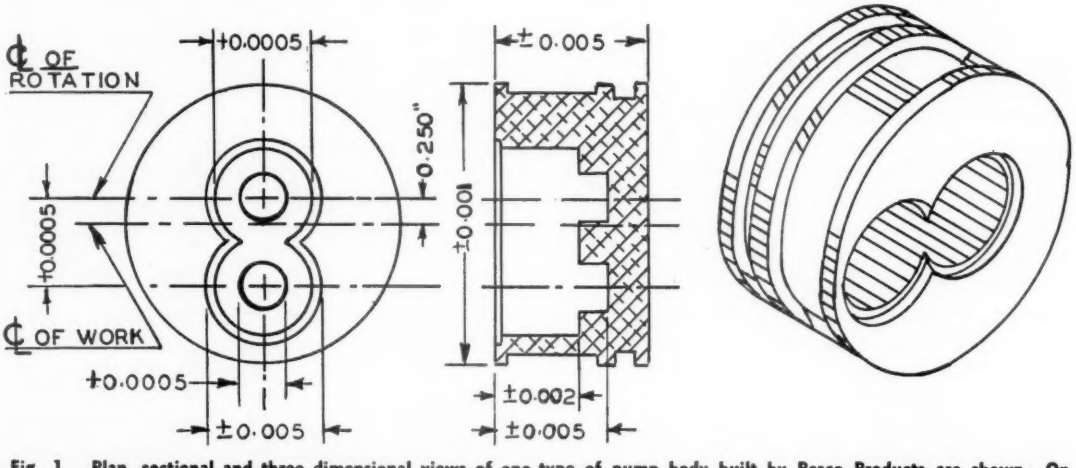


Fig. 1. Plan, sectional and three dimensional views of one type of pump body built by Pesco Products are shown. On the plan view the center line of the workpiece and the center of rotation of the part during the machining operations are indicated.

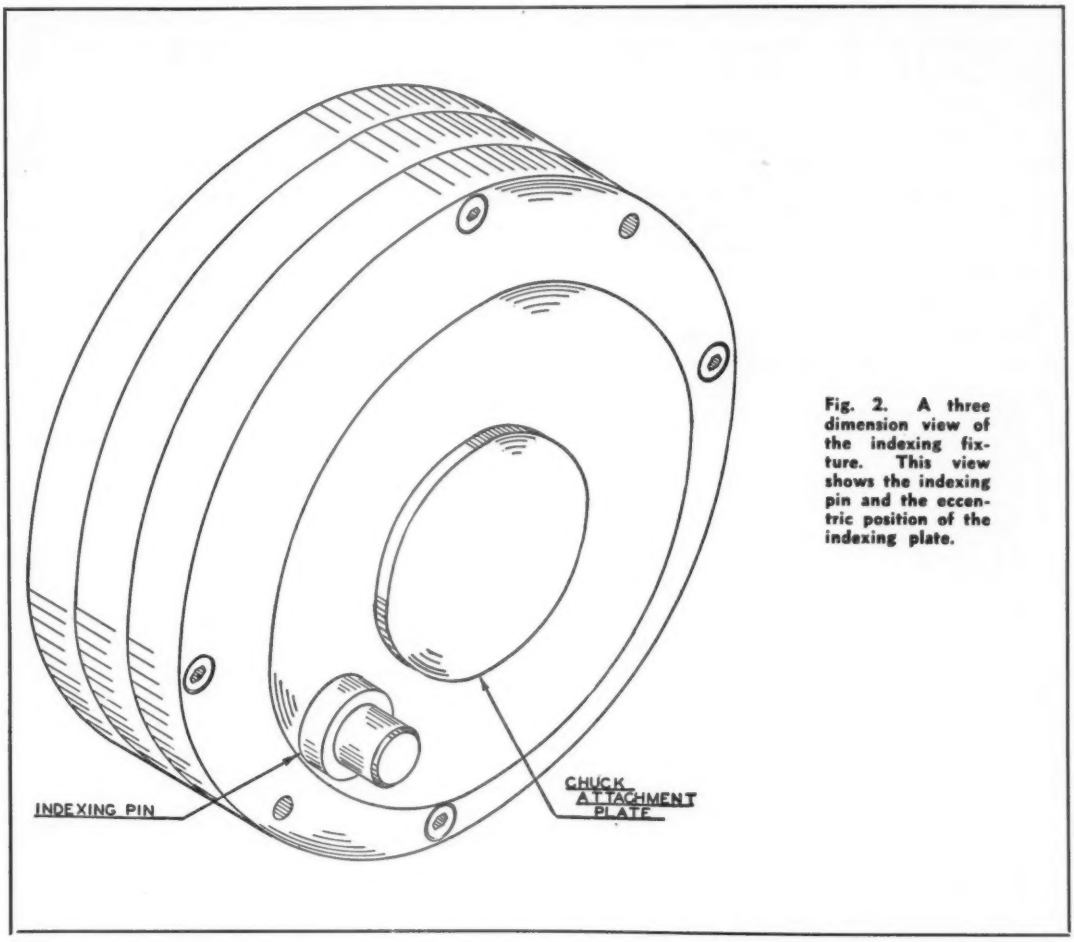


Fig. 2. A three dimension view of the indexing fixture. This view shows the indexing pin and the eccentric position of the indexing plate.

Thus, it was necessary to build a fixture for each type and size of body to be produced. As the range of body sizes increased the fixture inventory also increased. To control this inventory problem the fixture was redesigned so that now the distance between the spindle center and the work center is adjustable within certain limits. The fixture shown in Figure 3 can be adjusted from .350″ to .850″ between the spindle center and the work center. The top plate of the fixture can be indexed 180°, thereby making possible a center distance range of from .700″ to 1.700″. The section through C-C shows the means of making this adjustment.

The locating pins are positioned on the center line of the work, so that as the fixture is indexed 180° the center of the hole to be bored coincides with the spindle center of the machine.

To provide for holding a range of different body diameters, the fixture was designed so that the proper type and size of chuck can be attached to the fixture plate. When the indexing fixture is mounted on the turret lathe, the chucking center of the fixture will coincide with the center of the lathe spindle. Then when a workpiece is chucked in the fixture, its center will be at a distance from the spindle center equal to that specified for the part. For example, the type of body shown in Figure 1, is designed so that the center of the workpiece is .250″ from the spindle or rotation center.

The spindle center location on the part is then the center of one of the cavities. The center for boring the other cavity is located by indexing the fixture top plate 180°.

Operation Cycle

The first cavity is rough finished by drilling the small diameter hole with a twist drill set up in the first turret station; a step-tool is mounted in the second station for semi-finishing the small diameter hole, drilling the large diameter hole and counterboring the outer end. The fixture is then indexed

and the rough and semi-finishing operations are repeated to form the second cavity.

The second cavity is next finish machined with single point boring tools. The bottoms of the small and large diameter holes are faced with facing boring tools set up in the third and fourth turret stations respectively, and the walls of the small and large diameter holes are finish machined with boring tools mounted in the fifth and sixth turret stations respectively.

The fixture is then indexed again which brings the first cavity back into the machining position. This cavity is finish machined in the same sequence as outlined for the second cavity.

Only rough machining is performed on the counterbore as this is finished in a later operation.

From experience it has been found that if the first cavity were completely rough and finish machined in a following sequence of operations, the uneven distribution of weight due to the part revolving off its center causes an unbalanced condition and makes it difficult to hold acceptable tolerances on the finish machining operations. For this reason, the first cavity is only rough machined in the initial position of the part, and is not finish machined until after the part has been indexed for the rough and finish machining of the second cavity.

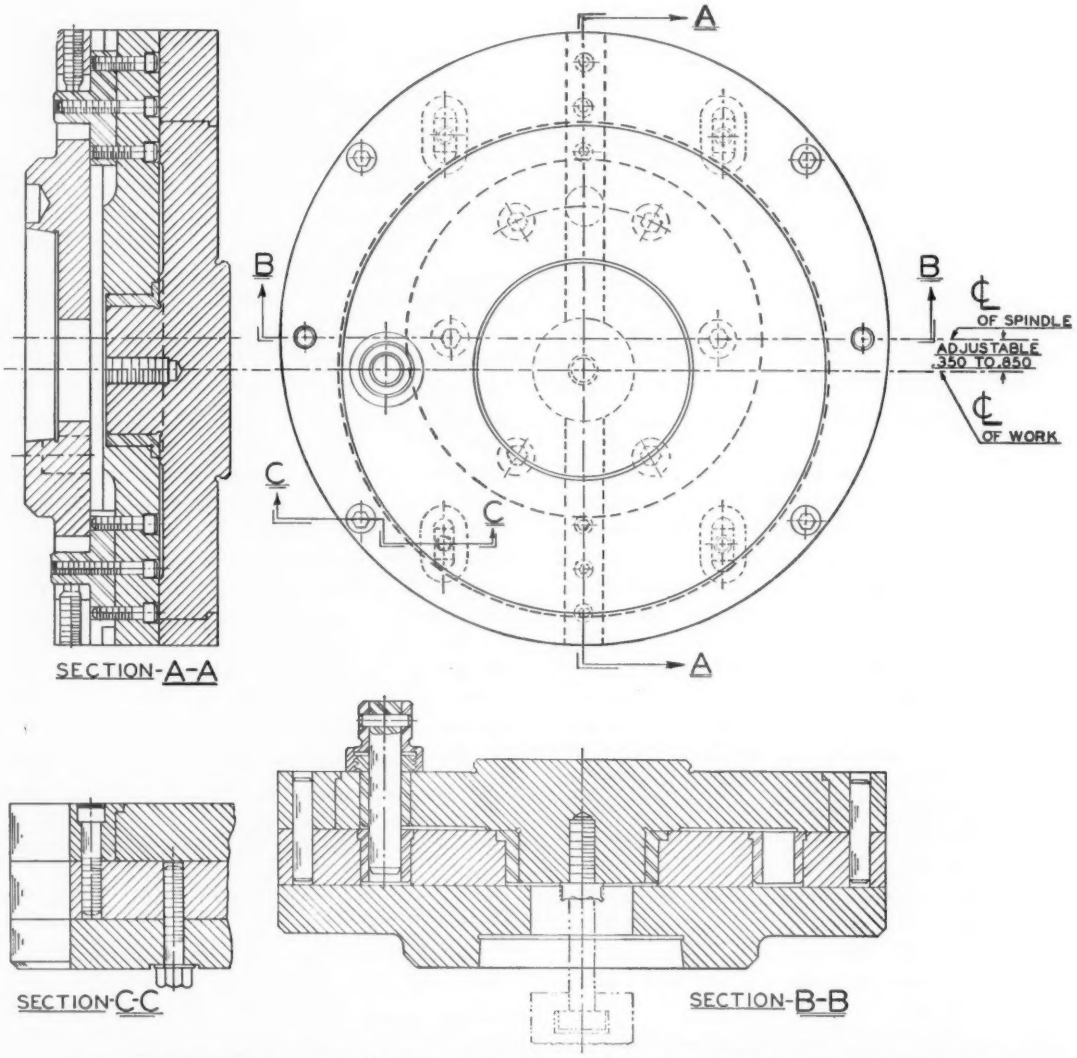


Fig. 3. The assembly layout of the fixture is shown with the vertical and horizontal cross sectional views.

TUNGSTEN CARBIDE HARD FACING

by Howard S. Avery
Research Metallurgist
AMERICAN BRAKE SHOE COMPANY
Mahwah, New Jersey

WHILE SINTERED COMPACTS of the carbides of tungsten, titanium and similar metals are well known to production engineers, the related technique of using tungsten carbide in welded overlays is relatively neglected. Hard facings of this type have proved extremely valuable in oil fields, on digging and earth moving equipment, and in many diverse applications. This article is intended to describe some characteristics of this wear resistant material in order that ingenious engineers can exploit its properties to their advantage.

The tungsten carbide used for hard facing differs from that employed in tool tips, dies, and the like. Instead of being a powder metallurgy product, it is melted in electric furnaces, cast, subsequently crushed into angular granules, and sized by screening. The granules, ranging from about ⅛" diameter downward, are sold in bulk or enclosed in steel tubes as composite welding rods.

The cast product itself is a mixture of the two carbides, WC and W_2C. Unlike the sintered product, there is no cobalt binder within the granules. Cobalt lowers the abrasion resistance of the cast metal, as it does for sintered or cemented carbides[1], but it is ordinarily employed only when a lower melting point is required, as in casting small slugs or inserts for welding in critical locations. Some attempts have been made to use crushed sintered carbides for welding, but to date the result has been an inferior product.

COMPOSITE TUNGSTEN CARBIDE HARD FACING
TUNGSTEN CARBIDE GRAINS SIZED AS SPECIFIED Usually 60% by weight
MILD STEEL TUBE Usually 40% by weight
TUNGSTEN CARBIDE GRAINS PARTIALLY DISSOLVE IN THE MOLTEN WELD METAL
HARD FACING DEPOSIT
MAGNIFIED 10X
ARC
WELDING BASE

Fig. 1. Tungsten carbide hard facing with tube rods. The deposited metal consists of tungsten carbide granules scattered thru a matrix of tungsten steel or iron, depending on carbon oxidation and dilution.

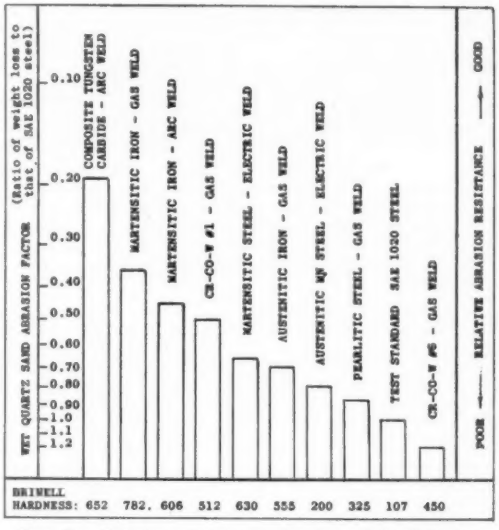


Fig. 2. Relative abrasion resistance of hard facing alloys.

The commonest composite rod is a tube of mild steel filled with granulated carbide (Fig. 1). Small proportions of other materials, such as arc stabilizers, binders and the like may be included. Different percentages of steel and filler are employed for some applications. These may be obtained by variations of tube thickness or by inclusion of iron powder in the filler. The latter is especially suitable if a low proportion of carbide granules is wanted.

Most of the commercial rods are standardized on about 60% filler and 40% sheath, by weight. Either coarse or fine granules may be obtained, and rods are available with 5-8, 8-10, 10-20, 20-30, 30-40, and -40 mesh sizes. A designation such as 30-40 indicates that the sized material will pass a 30 mesh per inch screen but be retained on a 40 mesh screen.

The rods may be used either bare or coated as electrodes for arc deposition. Gas welding

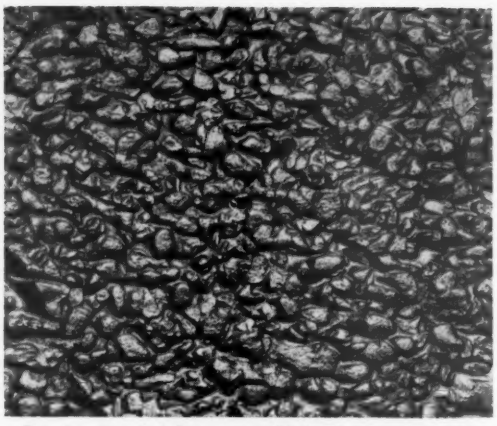


Fig. 3. Abraded Face, magnified 5X, of a composite tungsten carbide gas weld deposit from tube rod containing 20/30 mesh granules. High stress grinding abrasion with wet loose quartz sand produces this rough surface by differential wear of the hard matrix in which the very hard carbide granules are anchored.

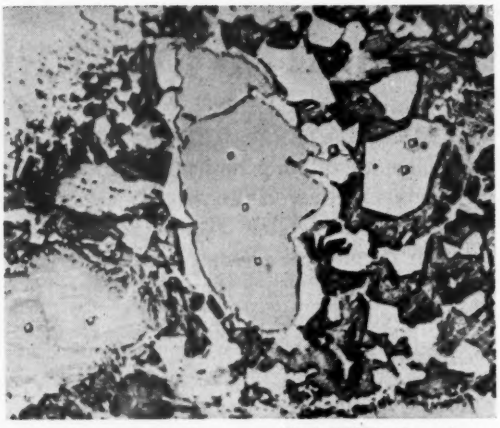


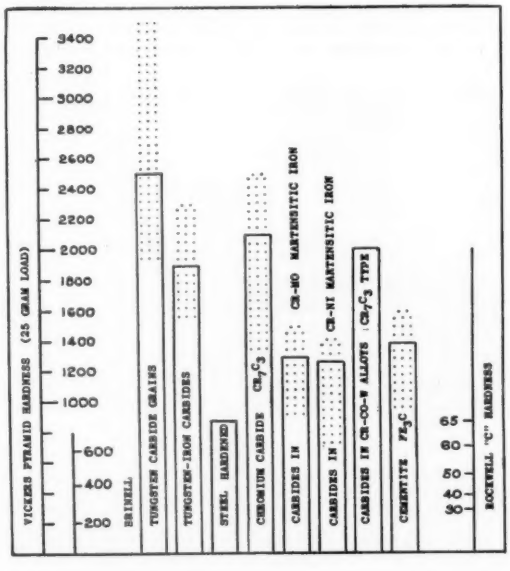
Fig. 4. Cross section, mganified 500X, through a composite tungsten carbide gas weld deposit. The large light grey areas are granules of very hard primary tungsten carbide. They are surrounded by a zone of hard secondary carbide that forms by reaction with the molten iron during welding. The matrix contains martensite (hardened steel) and scattered crystals of the secondary carbide, $(Fe,W)_6C$. The tiny rectangular marks are Vickers micro hardness test impressions.

is done with bare rods. Tungsten carbide weld deposits are considered unmachinable and are very difficult to grind. If care is used, and the metallurgical changes produced by welding are held within reasonable limits, the deposits from such composite rods provide outstanding resistance to high stress grinding abrasion (Fig. 2) and to frictional metallic wear. Their composite structure may permit differential wear and allow the hard granules to stand in relief. The resulting "cleated" surface (Fig. 3) can be a distinct asset if a rough, non-skid face is wanted, though it may be detrimental to a smooth contacting area. The sheath tubing melts during welding and dissolves enough of both tungsten and carbon to form a hard matrix that anchors the very hard granules in place. Instead of being a mild steel binder for the tungsten carbide as is sometimes believed, this matrix has characteristics that range from those of tungsten steel to cast iron structures containing considerable secondary tungsten-iron carbides.[2]

Surface roughness of abraded deposits depends on initial granule size and welding procedures. Abrasion resistance depends largely on the volume of undissolved carbides, and is generally better for gas welds.

The granules are, of course, much harder than any hardened steel, which can attain a maximum of perhaps 800 Brinell. The familiar Brinell test is of no value beyond 800 BHN; but, the Vickers test, depending on the same mathematical basis but using a diamond indenter, especially with the light loads of micro-hardness techniques, can measure effectively the high hardness levels of such carbides. Using a 25-gram load, the VPN (Vickers Pyramid Number) of the primary tungsten carbides granules is about 2400, while that of the secondary tungsten-iron carbides, $(Fe,W)_6C$, is near 1750 (Fig. 4). The matrix constituents are softer, being in the range of hardened steel. Figure 5 provides a comparison with various hard compounds.

Fig. 5. Relative hardness of carbides in hard facing alloys.



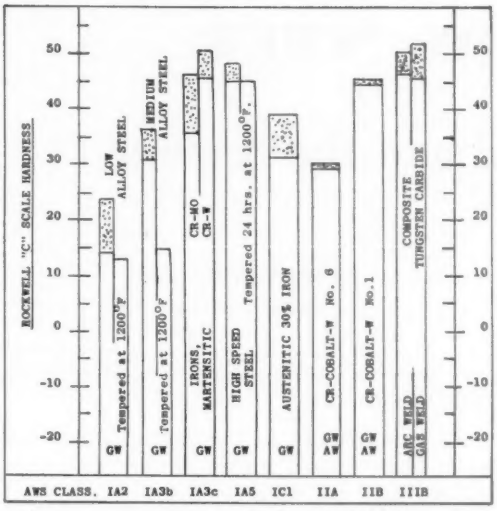


Fig. 6. Comparative hot hardness at 1000° F. Stippled zones indicate loss of hardness during 2 min. under load.

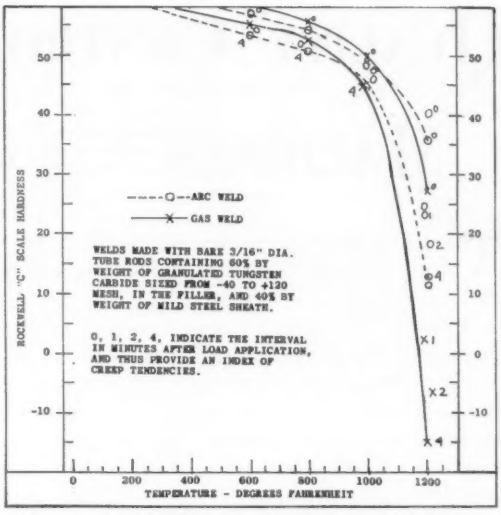

ROCKWELL "C" SCALE HARDNESS
ARC WELD
GAS WELD
WELDS MADE WITH BARE 3/16" DIA. TUBE RODS CONTAINING 60% BY WEIGHT OF GRANULATED TUNGSTEN CARBIDE SIZED FROM -40 TO +120 MESH, IN THE FILLER, AND 40% BY WEIGHT OF MILD STEEL SHEATH.
0, 1, 2, 4, INDICATE THE INTERVAL IN MINUTES AFTER LOAD APPLICATION, AND THUS PROVIDE AN INDEX OF CREEP TENDENCIES.
TEMPERATURE - DEGREES FAHRENHEIT

Fig. 7. Hot hardness vs. temperature of tungsten carbide weld deposits.

Tungsten confers hot hardness, and the matrix of the composite weld deposits retains its hardness at elevated temperatures considerably better than ordinary hardened steels. (See Fig. 6). The higher temperatures of arc welding permit more tungsten carbide solution during arc welding; and such welds, therefore, exhibit better hot hardness than oxy-acetylene gas welds.[3] For pattern of hardness-versus-temperature see Figure 7.

This pattern of carbide granule solution also affects abrasion resistance. A series of experiments[2] that are summarized in Figure 8 indicates that gas welds have better abrasion resistance, and that arc welds are further affected by carbide granule size. Since the toughness of the matrix has an adverse relation to its abrasion resistance, the engineer has at his command a qualitative control over arc weld properties through granule size specification.

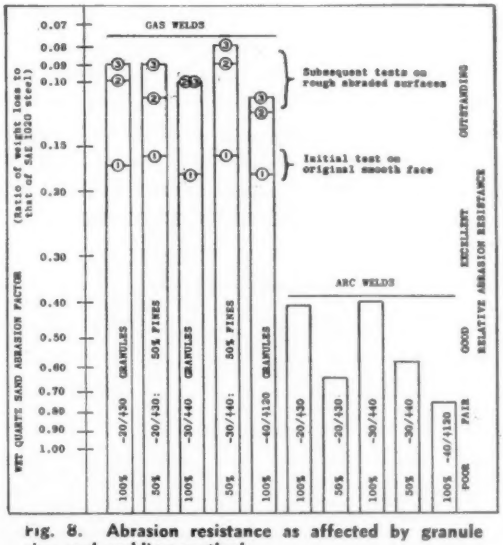


Fig. 8. Abrasion resistance as affected by granule size and welding method.

Gas welding usually provides a more accurate dimensional control than arc deposition. The usual deposit is perhaps ⅛" thick and is made with little or no fusion of the base metal. Arc welding is ordinarily less expensive.

Skilled welders can apply tungsten carbide hard facing considerably thinner than ⅛". They also can make it several times as thick, though the usual practice is to make the weld deposit only one layer deep. It is being applied to large workpieces and large surface areas; it is also used on rather light workpieces and to protect small surface areas.

A large virgin field for exploration exists on heavy industrial equipment where hard facing with tungsten carbide would offer many advantages. Also, there is a range of application where tungsten carbide hard facing and sintered or cemented carbide can be expected to compete for selection. Unfortunately, the extent of this range of application is not yet well defined, due chiefly to the limited experience of general industry with welded overlays.

Although the smoothness of the weld deposit can be controlled by the granule size used, differential wear and the potential

. . . *Continued on page 94*

QUALITY CONTROL ON SCREW MACHINES ... a need and the Answer

by W. N. Nordquist
Technical Editor

THE SCREW MACHINE PRODUCTS industry is rapidly moving toward a widespread adoption of statistical methods of quality control as a device for contract members to improve their respective competitive positions, to resist inroads of non chip-removing methods of manufacture, to lower inspection rejects, to increase machine productivity, to lower production costs, and to ensure a uniformity of output which will permit more accurate cost estimates.

Although far from being a unique attitude in industry, the idea that statistical methods of quality control had little application to their particular problems was long held by many firms specializing in screw machine products. The great variety of work, the complex tooling for multiple operations on a single machine, and the varying length of job runs . . . all were factors in resisting the introduction of statistical methods to screw machine work.

PROCESS SAMPLING TABLE

Lot Size	Sample	Accept
1 - 99	6	0
100 - 499	12	1
500 - 999	20	1
1000 - 1999	30	2
2000 - 3999	40	3
4000 & over	60	4

Figure 1

There have been, of course, notable exceptions to this pattern and some outstanding examples of applied theory are to be found in the screw machine contract shops.

Current defense production, the appearance of Military Standard 105-A, and the general rising competitive level of small parts procurement have, just in the last couple of years, served to emphasize a critical need for less than 100% floor inspection, for lower inspection rejects, and for increased productivity per man and per machine.

No automobile manufacturer, for instance, wants to subject every little screw and nut to 100% inspection. His sampling methods can become costly to him and/or the vendor, provided the latter has not taken measures to **control** his quality. Inspection is one thing; control is another.

At least one large car manufacturer has taken steps toward a goal of certifying vendors on the basis of price, delivery, and quality capability. This last — **quality capability** -- will mean, in effect, a rating of each vendor based upon his demonstrated level of quality delivered, **plus** his practices designed to ensure continuance of the same performance. These practices may include proper statistical methods, preventative machine maintenance, worker incentives, and so on. At the recent National Production Forum, sponsored by the Society of Automotive Engineers, the thought was expressed that eventually many of the larger manufacturers might collaborate in making possible a quality rating of vendors for use by all participating industry members.

What are the screw machine contract shops doing to meet this challenge?

Well, for one thing the Manufacturing Standards Committee of the National Screw Machine Products Association has initiated a program designed to remove the mysteries from statistical methods, to separate the wheat from the chaff, and to give their members the basis for evaluating quality control in terms of their own needs and then to get on with the job of installing an adequate control program.

PATROL INSPECTION REPORT

MACHINE NO. 34 DEPT. 200 DATE 5-1-51

STOCK NUMBER	COMPANY	PART NO.	OPERATION	LOT SIZE	S.S.	DEF.	DISPOSITION	INSP.
216	Lunberg	1234	Auto	280	12	1	A (Saw Sheet)	BB
"	"	"	"	353	12	0	A	"
"	"	"	"	160	12	3	R (Hole Chipped)	SB
"	"	"	"	205	12	0	A	"
				TOTALS	48	4	PERCENT DEFECTIVE	8%
261	Lunberg	1234	Auto	90	6	0	A	363
"	"	"	"	300	12	1	A (Two U.S.)	"
"	"	"	"	310	12	1	A (One U.S.)	"
				TOTALS	30	2	PERCENT DEFECTIVE	7%

Figure 2

LUNDBERG SCREW PRODUCTS CO. — ACCEPTANCE SAMPLING TABLES

"A" Characteristic Table

Lot Size	0 to 49	50 to 99	100 to 199	200 to 299	300 to 499	500 to 799	800 to 1299	1300 to 3199	3200 to 7999	8000 to 21999	22000 and over
First sample	10	13	20	25	35	50	75	100	150	200	300
Second sample	20	26	40	50	70	100	150	200	300	400	600

Quality Level	Acceptance Numbers																			
	C_1	C_2	C_1	C_2	C_1	C_2	C_1	C_2	C_1	C_2	C_1	C_2	C_1	C_2	C_1	C_2	C_1	C_2	C_1	C_2	C_1	C_2
3.2 — 4.3	0	2	0	4	1	4	1	5	2	6	3	9	5	11	6	16	9	23	11	32	16	47
2.2 — 3.1	0	2	0	2	1	3	1	4	1	5	2	6	4	8	5	11	7	18	9	24	12	35
1.2 — 2.1	→		0	2	1	2	1	3	1	4	1	5	3	5	3	9	5	13	6	16	8	25

"B" Characteristic Table

Lot Size	0 to 49	50 to 99	100 to 199	200 to 299	300 to 499	500 to 799	800 to 1299	1300 to 3199	3200 to 7999	8000 to 21999	22000 and over
First sample	3	7	10	13	20	25	35	50	75	100	150
Second sample	6	14	20	26	40	50	70	100	150	200	300

Quality Level	Acceptance Numbers																			
	C_1	C_2	C_1	C_2	C_1	C_2	C_1	C_2	C_1	C_2	C_1	C_2	C_1	C_2	C_1	C_2	C_1	C_2	C_1	C_2	C_1	C_2
3.2 — 4.3	→		0	2	0	2	0	4	1	4	1	5	2	6	3	9	5	11	6	16	9	23
2.2 — 3.1	→		→		0	2	0	2	1	3	1	4	1	5	2	6	4	8	5	11	7	18
1.2 — 2.1	→		→		→		0	2	1	2	1	3	1	4	1	5	3	5	3	9	5	13

C_1 — Number of defective parts allowed in first sample.

C_2 — Number of defective parts allowed in combined first and second samples.

→ Use sampling plan to right of arrow. If sample size exceeds lot size, inspect 100%.

Figure 3

The NSMPA first established a sub-committee on Quality Control and issued a preliminary report to summarize the need, to define the basic objective of quality control as applied to screw machine work, and to give their members a quick look at some of the methods that had already been effectively used in the industry.

The committee drew liberally upon the experience of the Lundberg Screw Machine Products Company of Lansing, Michigan, where statistical methods had been used successfully for about five years. This company was operating 36 multiple spindle machines, plus a variety of second operation equipment.

The Lundberg concern employs, principally, a system known as the "fraction defective method" or "sampling by attributes". This means simply the selection of a given number of dimensions to be controlled, and checking a given number of pieces (samples) from a quantity (lot) to determine if the entire lot is acceptable by allowing only a given number (fraction) of the sample to be defective.

Here is the system in operation. In the manufacture of a ball stud, the first order calls for a quantity of 4,000 pieces. This is the "lot". Each work pan will accommodate 200 pieces. Each of these smaller quantities is a "sub-lot", of which there are 20 to make up the complete order.

Figure 1 shows the process sampling table used by Lundberg inspectors. This indicates how many pieces shall be considered a sample and how many defective pieces will be allowed or "accepted" in each sample. In our ball stud case, the sub-lot of 200 pieces will require a sample of 12 pieces, according to the table. Thus, the inspector will check 12 pieces from each pan and will accept the pan if he finds no more than one defective piece by checking 11 dimensions (characteristics). The size of a satisfactory sample for a given lot or quantity was determined by experience, and the "accept" figure by laws of probability.

Figure 2 shows a daily inspection record for a machine used to produce the ball stud. Column 7 (Def.) shows the number of defective units found within each sample taken. Column 8 indicates acceptance (A) or rejection (R), as well as noting what defect if any is found. The upper half of the chart represents the day shift, and the lower half the night shift. For the day recorded on this sample chart, only one sub-lot was rejected. The rejected sub-lot is then checked 100%, with the total percent defective being much less than the average percent defective shown.

These daily inspection records are used in developing quality trend charts, showing a continuous graphic record of the quality level attained by each shift on the particular ma-

. . . *Continued on page 56*

. . . Single Spindle, from page 45

high as 20° depending upon the specific alloy. This value of top rake will also vary with the machinability of the aluminum alloys; the free machining 11S-T3 alloy requiring about a 3° rake angle, whereas the other alloy types may have values varying from 5° to 10°. It must be remembered that the value of top rake may be a compromise between adequate chip control and accuracy of dimensions of the machined shape.

One limitation of circular form tools is the length of form permissible. Thus, where the length of the formed section is beyond the ratio of about 2.5 to 1, this being the ratio of length to the diameter of stock, the pressure of the forming tool may either spring or twist off the item being formed. In some instances, this ratio may be even less depending upon the specific job.

At this time it may be well to mention the use of the straight cut-off blade which is also activated from the cross slide position. The cutting-off blade has angular or beveled edges and when clamped to these edges, is pressed securely against the flat side of the tool post. The shear or cutting edge angle is usually 15°, however this may be increased to as high as 25° when the difficult copper base alloys are machined. These alloys are in the Group III classification which would include the phosphor bronzes, the nickel silvers, aluminum bronzes and beryllium copper. A 2° to 4° side clearance is employed, while the front clearance may be as high as 20°. A back rake angle is employed; the value of this specific angle depending upon the material type. Thus, a value from zero to 15° is employed for the copper base alloys depending upon the group classification. Rake angles for the aluminum alloys will vary[3] from 5° to 15°.

Drilling, Reaming, Tapping and Threading Tools

Drilling — In a sequence of operations which may involve either single or multiple drilling operations, a centering drill precedes actual drilling operations. This centering drill is simply a short, stubby drill which is set up and supported in the turret very close to the drill point. The purpose of this arrangement is to obtain high rigidity within the set-up and thus the drill cannot be easily deflected off center when cutting. Another purpose is to obtain a true centering point for entry of the succeeding drills. In many instances, old twist drills which have become too short for other uses are employed. The cutting lips are ground to a 60° angle with the axis of the drill.

Regular commercial drills of the two fluted, spiral type with straight shanks are quite commonly used for most work on automatics. However, drill design may vary in accordance to special requirements specified by non-ferrous materials. Thus, high or slow spiral drills are used in deep hole drilling of aluminum base alloys and for a large number of copper base alloys. Also in the drilling of deep holes of small diameters in brass, breakage may be experienced in the use of the straight fluted commercial drill. This often precludes the use of a half-round drill which permits good chip disposal.

Where cutting forces are not equal or balanced, the drill will chatter and crowd to one side, producing an unsatisfactory hole. The longer and smaller the drill, the greater is the importance to have equal cutting lips producing a balanced cut. The clearance angle of 12° at the outside edge is considered standard, however this value may be increased to as high as 20° in the drilling of the more difficult aluminum and copper base alloy compositions. In many instances, this value of clearance is also governed by the feed that is employed; heavy feeds often precluding the use of greater clearance angles.

The hook or cutting rake angle for the lip is given by the spiral flute. Occasionally the angle of hook will be too great where a free cutting material is drilled. This may result in the drill digging in or pulling ahead. If this should occur, grinding a small land below the cutting lip will change the amount of hook. The feed will generally be governed by both the hole diameter and the type of material that is being drilled. Lighter feeds should be employed where small diameter holes are drilled, where deep hole drilling is performed, or where high accuracy is to be maintained. The speed of operation is dependent upon the material; the slower speed being used for the more difficult materials to be machined.

In order to determine the cause for drilling difficulties, the following information[1] may be of value, thus:

(a) If the point is not central, the drill will cut oversize;

(b) If the cutting edge angles are not equal, the drill will cut unevenly with one lip doing most of the cutting;
(c) If the web is too thick, the drill will offer high resistance to feeding;
(d) If the web is too thin, the point of the drill will chip and break off;
(e) If there is insufficient clearance, the drill will require heavy pressures to feed into the stock. Examine closely since too thick a web will also give this same result. Rub marks will indicate too little clearance;
(f) If there is too much clearance, the cutting lip will be poorly supported and may chip or break off;
(g) If there is too much hook, the drill may dig in, pull ahead and overload itself. If there appears to be an in-and-out chatter, try reducing the hook or rake.

In the drilling of deep holes, it may be necessary to divide the total drill depth between several drills mounted on separate turret positions; each drill going to a predetermined depth. Thus, as an illustration, the maximum depths per drill entry on the aluminum base alloys are given. In other instances, especially with the austenitic stainless steels, positive cuts must be taken so that the drill will not ride, and thus produce a cold worked and burnished surface interior which may prove difficult to work on subsequent operations.

Table 2 Maximum Depths per Drill Entry for Aluminum Alloys[3]

Where such tools as reamers, drills, counterbores, etc. are held in the turret position, the floating holder is recommended; this holder being preferred due to its ability to accurately locate the true center of the work. Also, it should be remembered that drilling on an automatic is quite different than hand feeding due to the absence to the sense of feel. Thus, it is essential in automatic feed drilling operations that the tool bit be maintained sharp at all times so that it will cut freely. It is also essential to flood the drill with a good lubricant to keep the drill cool and to adequately wash the chips from the hole.

Reaming — Both the straight and spiral fluted reamers can be employed for the reaming of straight holes. In some instances, as is exemplified in reaming the aluminum alloys, large flutes are required so as to pass the chips readily, however the number of flutes should be adequate so as to obtain adequate support. Straight fluted reamers are widely used in the machining of the copper base alloys, however where chatter may be experienced, the spiral type reamer will overcome this difficulty and usually produce a smoother finish. Occasionally, the spiral fluted reamer may be required for deep holes, especially in the event that a flat drill was used previously leaving chips in the hole. In this instance, the straight fluted reamer will not remove all of these chips with the result that the hole may be roughened. In extreme cases, clogging and subsequent breakage of the reamer may result. The spiral fluted reamer can be used to advantage in the removal of these chips.

The reaming of tapered holes presents a different type of problem. With the aluminum base alloys, a spiral fluted reamer is generally used. Designed for taper work it has a spiral of direction opposite to the direction of cutting. These reamers have less tendency toward chatter and to 'hog' into the cut. For tapered sections on the stainless steels, where a fine finish is required, the use of a taper turning attachment will prove more satisfactory than a tapered reamer. However, in this instance, a tapered reamer can be used where an average finish is all that is required.

The reamer teeth do all their cutting at the front end where they are chamfered to create a cutting edge; this chamfer angle being as high as 45° in the reaming of some of the non-ferrous alloys. Narrow margins or lands are required so as to reduce the friction between the tool and the hole and thus minimize heat generation. However,

. . . *Continued on page 60*

Table 2. Maximum depths per drill entry for aluminum alloys[3]

Drill Type	First Drill (In Drill Diameters)			Second Drill (In Drill Diameters)			
	1st Entry	2nd Entry	3rd Entry	1st Entry	2nd Entry	3rd Entry	Subsequent Entry
Standard	4	1½	¾				
High Spiral, Straight flute Slow Spiral	5	2	1	1½	¾	½	½

. . . Quality Control, from page 53

chine. This chart is posted on the machine, so that the operators can observe how their work stacks up against others and against previous days.

In final inspection, six characteristics are checked. Each of these is specified as being in Group A or Group B, depending upon the critical nature of each dimension. Figure 3 shows the acceptance sampling table, which indicates the methods for sampling inspection of Group A and Group B characteristics. To show the use of this table, let us check our sample ball stud on one specific dimension which has been identified as a Group A, or major, characteristic.

If we have a lot of 200 units, we see from the table that 25 units are to be taken in our first sample. Lower down in the same column are shown the "Acceptance Numbers". On the line identified at far left as 1.2-2.1, since we are shooting for a 2% quality level, we see that only one defective part can be accepted in the first sample (C). If we find two defective parts, a second sample must be taken. From the chart, we find that this second sample is to be 50 units and that a total of three defective parts is the maximum to be allowed from both the first and second samples (C_2).

This same "double sampling" is employed for Group B characteristics, except that the sample sizes are only half as large. Figure 4 shows the final Quality Record for Outgoing Production, covering Group A characteristics. A similar record is made covering Group B chaacteristics. A final Quality Trend Chart is also developed to show graphically the per cent defective over a period of time.

The original NSMPA report showed numerous other charts and described several special types of statistical methods being used by Lundberg to meet specific problems.

The NSMPA report was favorably accepted by association members, and the committee proceeded to plan, with the cooperation of the American Society for Quality Control, a series of at least three manuals dealing with the subject of Quality Control as applied in the screw machine products industry. A supplement to this material, the "Manual on Sampling Inspection by Military Standard, MIL-STD-105A", has already been published, having been rushed to completion because of the need of many firms engaged in defense production.

This explanation of Mil Standard 105-A was authored by Irving W. Burr of the ASQC and professor of mathematics at Purdue University. A specific example lifted from his report is shown in Figure 5. The part is a sleeve control cam. Defects are classified according to their importance: In this example,

LUNDBERG SCREW PRODUCTS CO.

OUTGOING MATERIAL — QUALITY RECORD

Company: LUNDBERG Group: A

Part No.: 1234

1950-1 Date	Lot Size	1st Sample: Sample Size	1st Sample: Defectives Allowed	1st Sample: Defectives Found	% Defective	2nd Sample: Sample Size	2nd Sample: Total Defectives Allowed	2nd Sample: Total Defectives Found	DEFECTS: 1.122-1.125 O.S.	DEFECTS: 1.122-1.126 U.S.	Heat Treat	Disposition	Inspected By
7-15	1100	75	4	1	1%				1		OK	A	802
7-17	2700	100	5	2	2%					2	OK	A	811
7-18	1800	100	5	3	3%				2	1	OK	A	802
10-27	2050	100	5	6	6%	200	11	10	3 (C)	3 (C)	OK	A	*
10-28	1200	75	4	1	1%				1		OK	A	804
10-31	4300	150	7	2	1%				1	1	OK	A	811
11-2	750	50	2	0	0						OK	A	805
1-25	3300	150	7	2	1%				2		OK	A	810
1-27	2100	100	5	2	2%				1	1	OK	A	802
1-29	1200	75	4	3	4%				3		OK	A	804
3-30	2450	100	5	5	5%					5	OK	A	804
5-12	1600	100	5	2	2%					2	C-46-55	R	811
5-14	850	75	4	2	3%				1	1	OK	A	802
5-15	1750	100	5	0	0						OK	A	805
5-16	2900	100	5	1	1%					1	OK	A	804

Figure 4

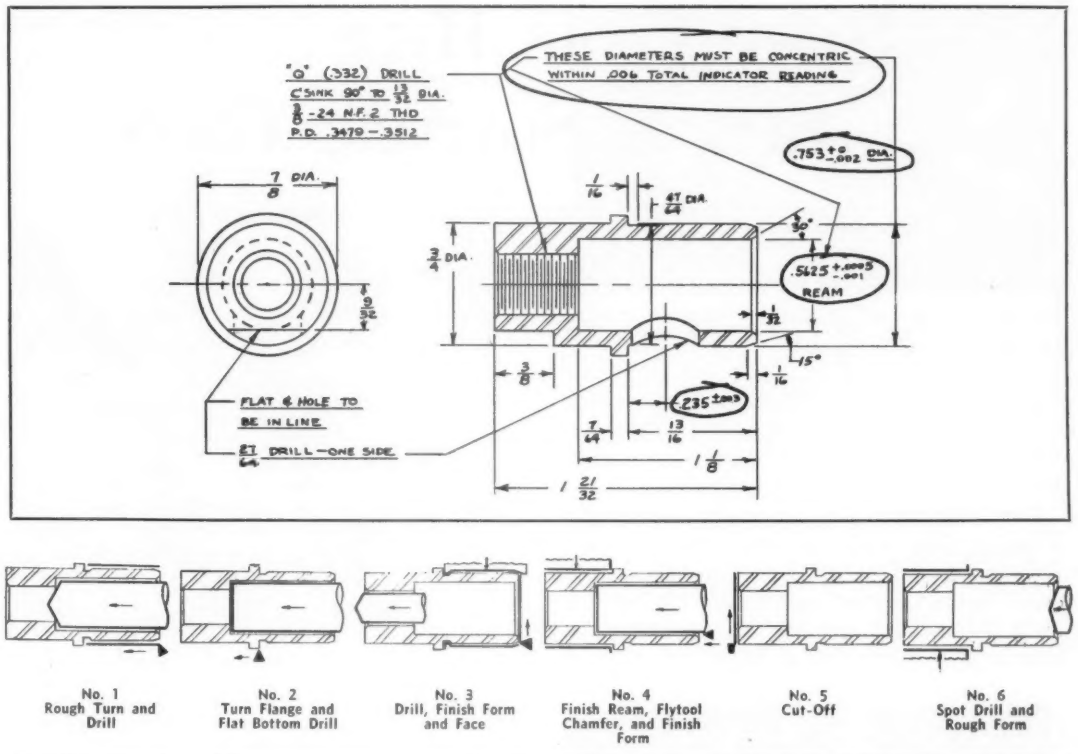


Figure 5

none of the dimensions are "critical". Those circled on the part print are **major;** all others **minor.**

Parts are processed through eight operations. The first of these is "automatic" work, performed on a 1"—six spindle Acme Gridley Automatic. Work done at each station is shown by the series of operational views immediately below the part print in Figure 5.

Cams pass through a "toll gate inspection" at the end of the automatic department, in sub-lots of 500 to 800 units. The sub-lots are sample inspected against the appropriate inspection instruction sheet. If a lot is rejected, it is sorted 100%; or, if accepted, it goes to the next operation. A control chart, showing per cent of defective pieces by samples, maintains control of the quality of production from the automatic.

Other operations, subsequent to work on the automatic, are either spot checked or acceptance sampled at point of processing. In final inspection, double sampling is employed according to tables given in Mil-Std.-105A.

Of the four characteristics or "defects" circled in Figure 5, let us suppose that a lot of 800 cams had two with diameters outside of the specifications 0.751" to 0.753", two with the ream outside of 0.5615" to 0.5630", and one which had both measurements outside of specification. These would count as five "defectives". The lot quality is then 5/800, or 0.625% defective. Since this is below the specified A.Q.L. of 0.64%, such a lot is of acceptable quality. A similar A.Q.L. exists for each of the other "defects".

The NSPMA Manual A proceeds to show how to select the appropriate sampling plans for this example, using tables found in the Military Standard. The manual also provides a general interpretation of the government's sampling procedures and explains their use by industrial concerns.

Volume I of the series covers the "What and Why" of statistical quality control and constitutes a good general introduction to the subject. The joint committee of NSMPA and ASQC has done a remarkably effective work in simplifying this subject, and the manual will undoubtedly be a very valuable tool in training inspectors and quality control engineers, as well as making it possible for top management to become fully conversant with one of the most important cost-reduction tools available to them—Statistical Quality Control.

Volume I is being printed, at the date of this writing, and will probably be immediately available.

Band Tools Help Reduce Slotting Costs

Slotting is a recent addition to the many operations now being band machined more economically than by conventional methods. No claim is made that this continuous cutting process is a cure-all but if all factors were better understood, it is likely that more production key-men would at least give band machining preliminary consideration. Such a measure has seldom led one in the wrong direction.

Band slotting has numerous advantages whereby low unit cost may be attained, whether the job calls for uniform slot widths as in Figures 1 and 2 or for such applications as in Figures 3, 4 and 5 where a slight variation in kerf dimension is secondary to optimum cutting rate consistent with blade life.

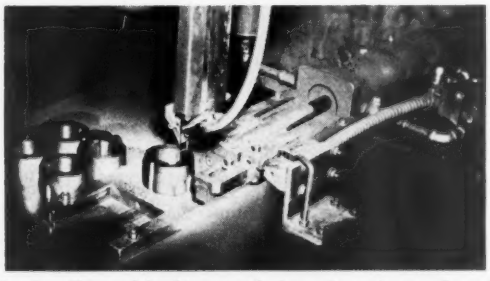


Fig. 1. Tapered bushings made in various sizes and used to lock V-belt sheaves on shafts are band slotted in a fraction of the time formerly required by milling. Air-cylinder type feeding fixture is semi-automatic and requires only loading by the operator.

The long cutting edge of the saw band, which varies in length according to the size of band machine being used, provides rapid cutting action with relatively little heat being generated. Excessive heat while cutting often proves critical in cases of circular tool slotting. Because the saw is not heated, it is not subject to the strains and stresses that are encountered by the circular saw or cutter mounted on an arbor. A saw band tends to readily correct itself from distortion. The longer the blade the cooler its cutting action. It all adds up to uninterrupted production for extended periods with no maintenance and down-time costs plus the additional savings in manpower and machine power.

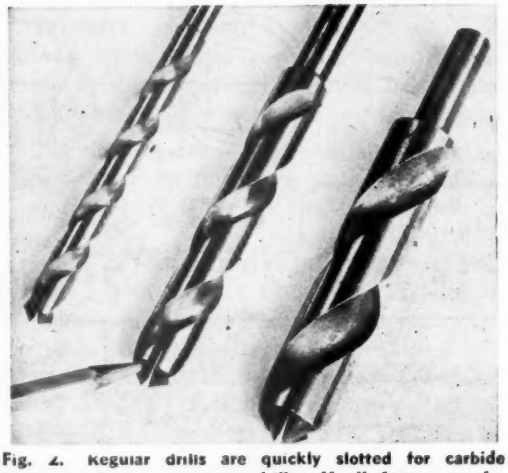


Fig. 2. Regular drills are quickly slotted for carbide inserts to become masonry drills. If all factors as determined for a particular slot width are properly controlled, the band will operate until cutting edge life is reached without losing excessive kerf width.

Choice of Set

Slot Width Versus Actual Set Dimension. The basic purpose of saw set is to create clearance for the back of the blade. However, for slotting the set must function with far greater accuracy than required under just plain cutting operations. A band intended for slotting must primarily be selected on the basis of uniformity of set. This is possible only through constant quality control in saw band manufacturing starting from raw materials through to the finished product. If the set of the band will resist the strains of contour sawing, such a band will definitely prove even more effective for slotting and particularly so if uniformity of slot width is a must.

Standard saw blades come with sets ranging from .038″ to .065″ and will, generally speaking, produce slot widths of .032″ to .063″ or .002″ to .006″ narrower than actual set dimensions. Special blades are also available for cutting slots ranging from .025″ to .100″ with a single pass of the blade. The .025″ dimen-

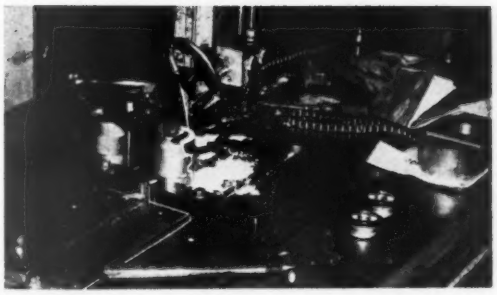
by H. J. Chamberland
Research Engineer
THE DOALL COMPANY
Des Plaines, Ill.

sion applies to a no-set blade.

To determine the size of slot, a standard "Raker" set band will cut, it is necessary to start with the known set dimension of the teeth. If, for example, the set is .042", that particular band will cut a kerf approximately .039" but other saw control factors are essential to hold this relationship in line. (1) Some

wide set blades cannot be used on thin materials since the pitch in which the blades are furnished cannot provide a two-tooth contact with the material. (2) The thicker the material the greater the feeding pressure required which in turn tends to spread the set. (3) The set also has a tendency to spread in dense materials, therefore, the higher the density of the material the wider the kerf.

Generally speaking, a narrow set and fine pitch saw band used with high velocity and slow feeding rate, will provide a slot or kerf



size which more closely approaches the overall set dimension. Saw pitch and amount of set will also influence the ultimate surface finish which is often significant with slotting operations. A fine pitch and light set will usually give the finest finish, particularly in conjunction with high band velocity, slow feeding rate and use of saw lubricant.

The next contributing factor to accuracy of cut is to use the widest and thickest blade possible. It is important that the saw retain its stability between upper and lower guides and thus provide additional beam strength for heavier feeding force. Band thickness is however limited by the diameter of machine wheels, since the larger the wheel the thicker the band may be. The formula for determining the approximate relation between both is .001" to .00175" of band width for each inch of wheel diameter.

Several different types of band tools, each

. . . *Continued on page 131*

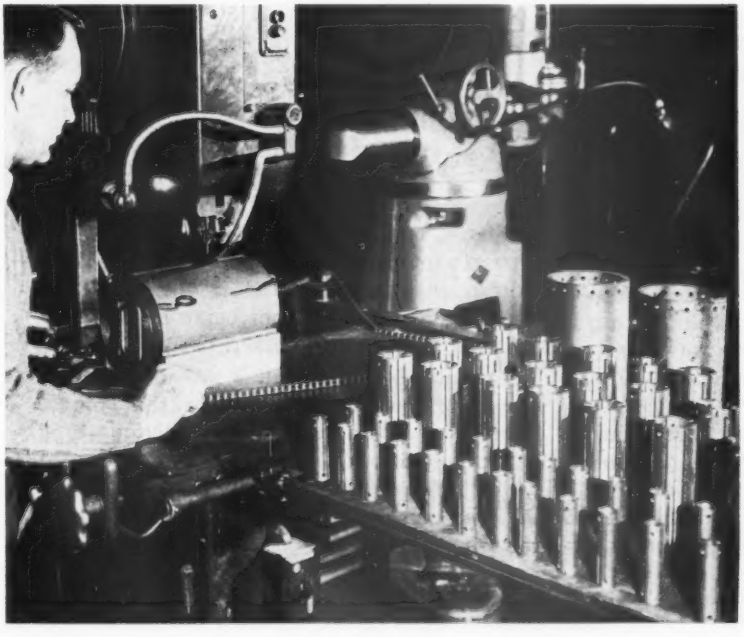


Fig. 3. Above left. Slotting brass brush holders. This application concerns a reasonable compromise between cutting rate and tool life rather than cut surface finish. The mechanical feed and magnifying glass attachments combine to relieve the operator of fatigue and help him observe the cutting results more closely.

Fig. 4. Left. This band machine is kept in continuous operation slotting expanding mandrels. The ingenious indexing fixture assures parallel and evenly spaced cuts with high cutting rate commensurate with blade life.

Fig. 5. Above right. As shown here, parts in limited quantities may be readily clamped to the band machine table and fed into the wide blade hydraulically. Simple setups such as this often apply to short runs that would otherwise incur greater down-time costs.

. . . Single-Spindle, from page 55

care should be taken so that these lands are sufficiently wide to offer sufficient support; a value of 1/64″ to 1/16″ width being given depending upon the size of the tool. The clearance angle behind the cutting edge is usually up to about 10°, and since this clearance angle may be ground either straight or with a slight hollow, a secondary clearance angle may be required to prevent the back of the land to rub on the side of the hole.

Rake angles will vary with the relative difficulty of machining of the specific material; the higher values of rake being employed for the more difficult materials. Feeds and speeds employed will also vary not only with the type of material, but also in accordance to such factors as tooling material, desired finish, depth of cut, diameter of hole and the number of flutes on the reamer design. With the stainless steels, from 0.003″ to 0.010″ of metal is removed at about 0.003″ to 0.0075″ feed per revolution. As is to be expected, surface speeds will proportionally increase in reaming operations where carbide tooling is employed. In addition, surface speeds will vary with the finish; the smoother finish desired requiring slower speeds.

Sufficient metal for reaming should remain after drilling is completed, this being especially important where the wall thickness is small in relation to its diameter. Conversely, if too much stock is left in a drilled hole resulting in that a heavy chip must be removed, a large or oversized hole may result. In reaming the aluminum alloys, excessive heat generation realized by a combination of a thin wall and a heavy cut may result in a small hole. Thus, in this latter case, heat generation is objectionable due to the high thermal expansion of this material. Accurate grinding, where angles and clearances are maintained exactly, is required, so that even cutting by all teeth is done. Thus, where a feed of 0.012″ per revolution of stock is maintained, each tooth of a six fluted reamer should remove a chip of 0.002″ thickness.

Tapping — One of the greatest difficulties in tapping, or internal threading, is that of having chips clog back of the cutting edge, causing the tap to "seize" and break when the spindle reverses, particularly when running at high speeds. For this reason, taps with two flutes are usually used for steel up to

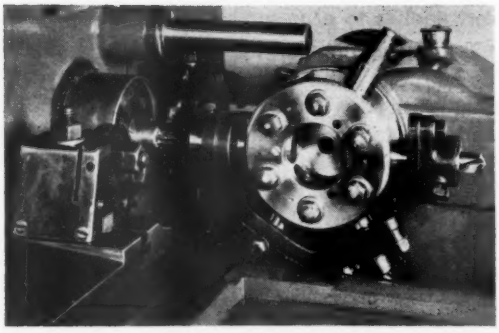


Fig. 5. Tap mounted in a non-releasing tap holder. These holders are used on automatic screw machines where the spindle is reversed automatically.

3/8″ in diameter. For holes in steel of diameters greater than 3/8″ and for most copper base alloys the standard three or four fluted taps having narrow lands and deep, polished flutes with a two or three thread chamfer would be employed. With some of the more difficult non-ferrous alloy types, where tough stringy chips may be encountered, the spiral tap with two or three flutes are the preferred. Chamfer angles used in tapping are similar to that used for threading and will be further discussed.

The hook grind on taps will vary with the material type; the standard value used for steel and the more difficult non-ferrous metals is at about 15°. This value may be reduced for such materials as the free machining leaded yellow brass to about 2° to 4°. Usually, it is advisable not to tap over 75 percent thread; the increase in strength obtained by tapping above this figure is insufficient to warrant the increased difficulties experienced in tapping. For deep hole tapping, thin lands to reduce bearing areas are required, or an interrupted thread style tap can be employed. For tapping diameters of one inch or more, it may be advisable to employ collapsible taps. This type of tap, however, is somewhat more difficult to align as compared to the solid tap; improvement of alignment being obtained by the use of a floating holder.

Non-releasing tap holders are used on automatic screw machines where the spindle is reversed automatically. The releasing type of tap holder can also be used on automatics where it is not practical to provide a threading lobe on the lead cam suitable for a non-releasing holder. A typical tapping operation is illustrated in Figure 5.

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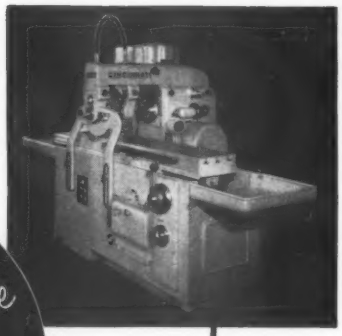

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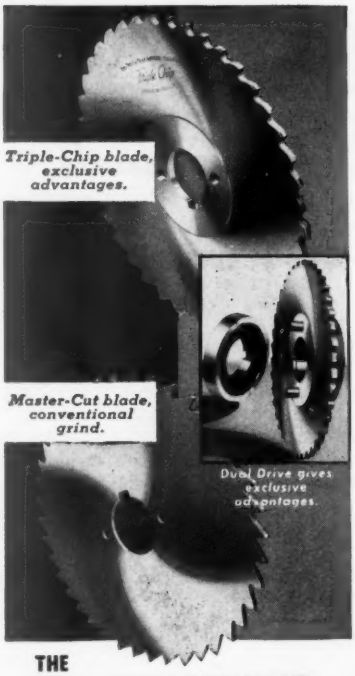

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The illustration shows one of the die assemblies used for manufacturing silicon carbide and aluminum oxide wheels at the Carborundum Company, Niagara

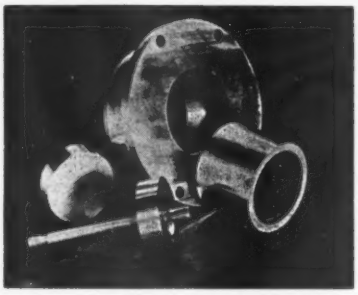
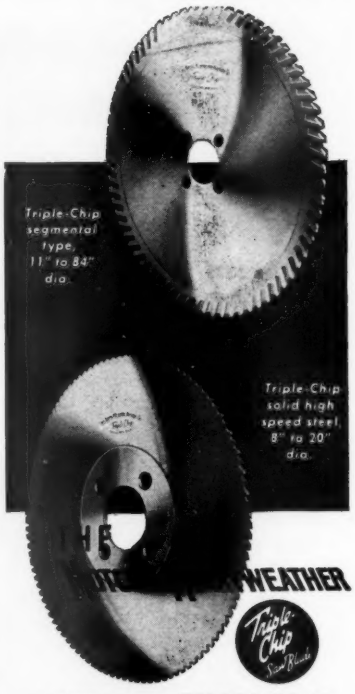


Photo courtesy Carbology Dept.

Falls, New York. The barrel liner, at lower right, is of grade 883 carbide, and the core pin, at lower left, of grade 44A. Both these materials are made by the Carboloy Dept. of G. E. Company, Detroit. The first is a material that provides high wear resistance and is fairly tough. The second is tougher but still has good wear resistance.

At Carborundum Company, these wear resistant inserts are providing an overall average working life about ten times that of other engineering materials. One four inch mold on an automatic press, for instance, produced as many as 86,000 grinding wheels and was still in good condition. The mold employed previously lost its efficiency at 2,500 pieces.

The cost of these tungsten carbide molds, according to Carborundum, averages about three times that of steel. But the cost is more than offset by the wear resistant qualities of the tungsten carbide metal.



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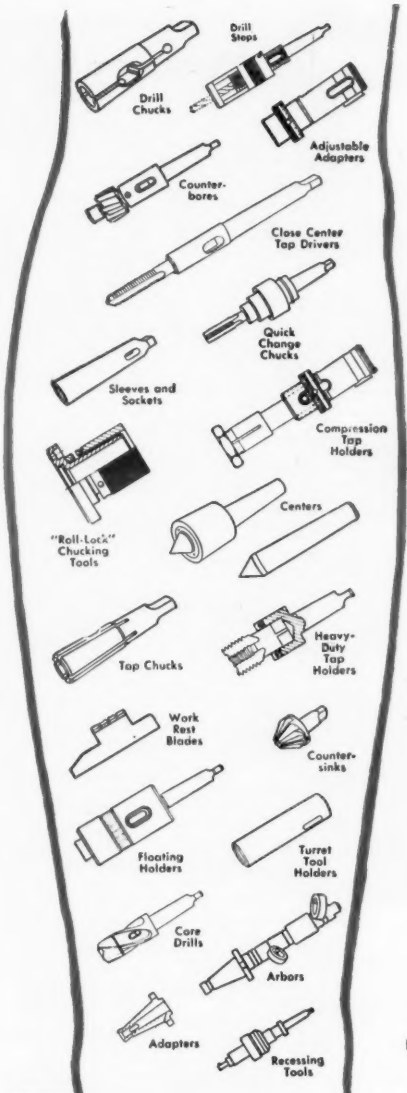

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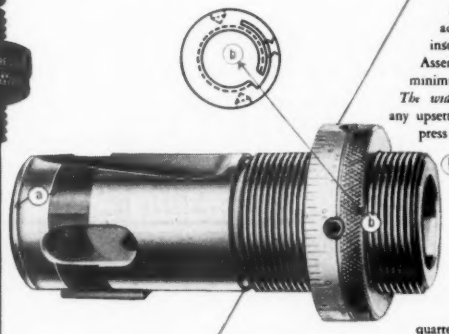

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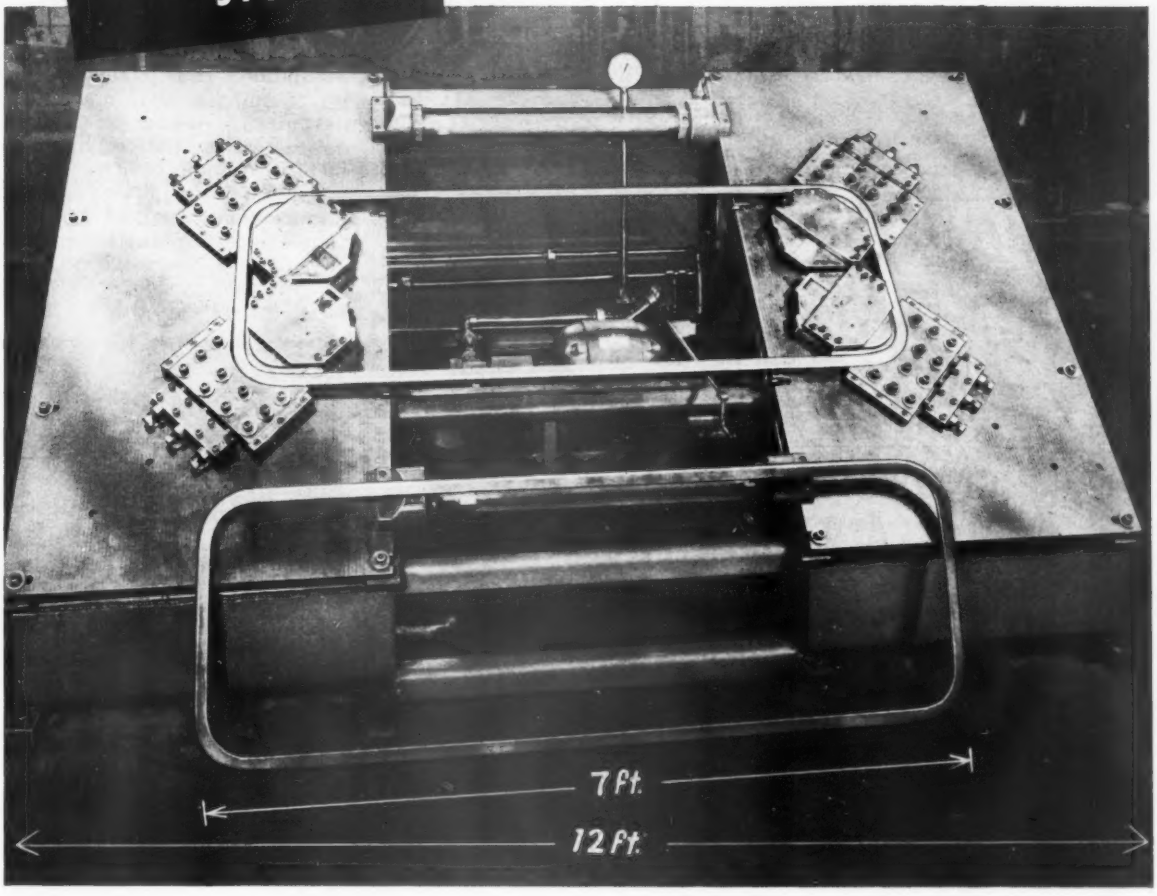

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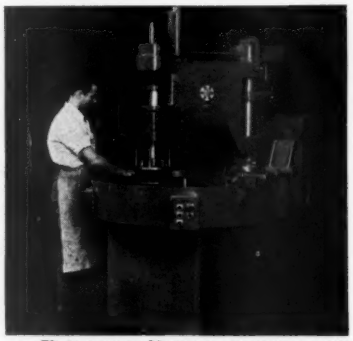

Photo courtesy Micromatic Hone Corporation

Direction of spindle rotation is controlled by a clutch that has three positions: forward, neutral, and reverse.

A knob at the lower right rear side of machine permits easy access to changing spindle and wheel speeds together. The abrasive wheel is geared to the same motor that drives the spindle, so that the speeds of both spindle and wheel may be proportionately changed at the same time by the one control.

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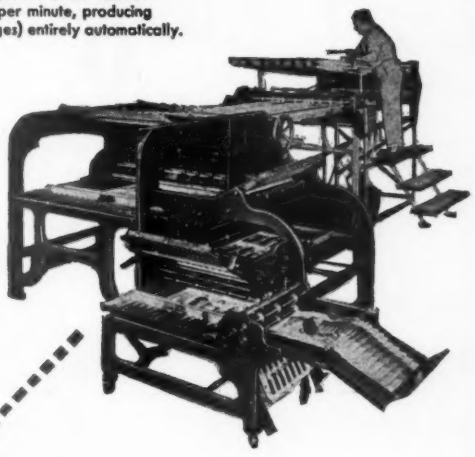
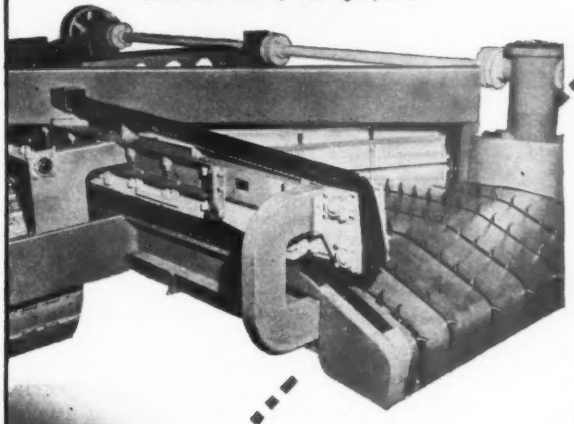


A RAMIE DECORTICATING MACHINE built by SEMCO, showing a "business end" view of the mobile unit that produces raw fibre from the fibrous RAMIE plant used for weaving into textile. Pictures of this machine in operation are considered of historical interest and are displayed in the Smithsonian Institute, Washington, D. C.



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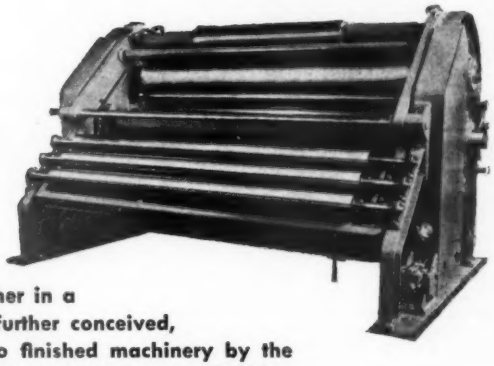

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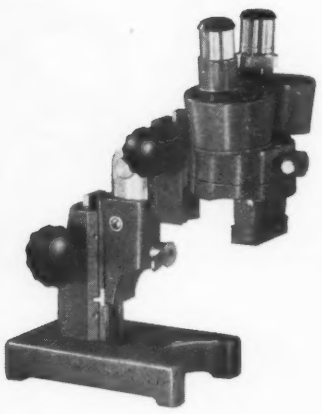

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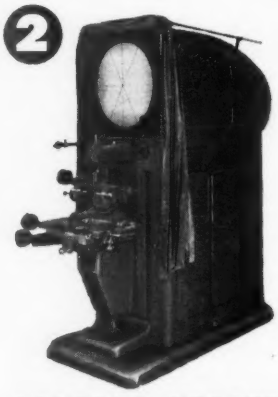

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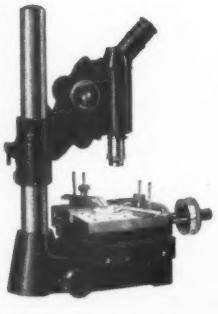

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How to Use Carbon Arc Burner in Battery Repair

Lead burning is becoming increasingly important in battery maintenance programs as industry becomes more alert to the economic advantage of more careful treatment of the primary energy sources which drive

Photos courtesy Gould-National Batteries, Inc.

Fig. 1. Proper technique in lead burning for battery repair involves using three cells of the battery (six volts) and a simple pointed carbon rod. Here a connector is being burned to a post—fresh lead being applied to the rod so that it flows down into the puddle, and damp rags being used to protect adjacent parts.

so many lift trucks, tractors, shuttle-cars and other industrial vehicles. Lead burning (welding) may be done with an acetylene and oxygen torch or with a carbon burning outfit. The latter uses electrical power from the battery being repaired and involves but the simplest of equipment. The following instructions and precautions are volunteered by Gould-National Batteries as part of its current plus-performance plan.

. . . *Continued on page 95*

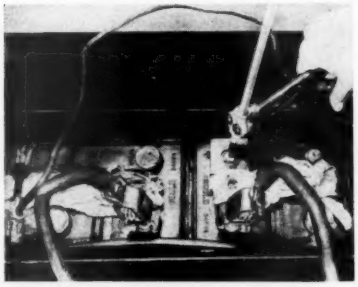

Fig. 2. When building up battery posts the use of a mold is helpful, but care must be taken to prevent the carbon rod from touching the side of the mold. The jumper connection in the foreground replaces a missing connector so that six volts (three cells) is across the weld.

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Also available are series AA, BB and CC die sections having wider lands which permit contouring before hardening. These standardized die sections have the same general construction as series A, B & C illustrated to the left.

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Precision Flat Lapping

Flat lapping machines have turned costly, laborious hand operations into a fast, economical, production process. Fine micro-inch surface finishes necessary in so many tool room jobs, can now be attained with a big saving in time.

A precision flat lapping machine was developed by lapping engineers, to provide a low cost tool for producing the finest micro-inch finishes with speed.

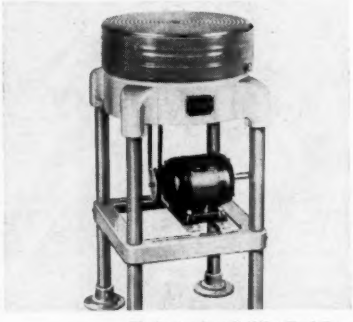

Photo courtesy Spitfire Tool Co.

It is a precision machine tool for quickly finishing parts that require exceptionally flat, finely finished surfaces such as sliding and rotating parts, gages, air-tight and liquid-tight seals.

Plastic and die casting molds can be lapped in record time. It is possible to obtain with this machine, finishes as fine as 2 rms micro-inches when lapping metals, glass, quartz or any other material requiring an extremely fine flat finish.

With this machine, precision lapping is accomplished by operators having little experience and in much less time than by other methods. No chucks, collets, holders or other tools are necessary. The operator merely holds work on the revolving plate which has been covered with abrasive. All work is done by the machine which is left running while the work is examined and measured. Speed of stock removal and fineness of finish are varied by selection of abrasive.

Large parts, ordinarily difficult to finish, are easily and rapidly lapped to an exceptionally fine finish.

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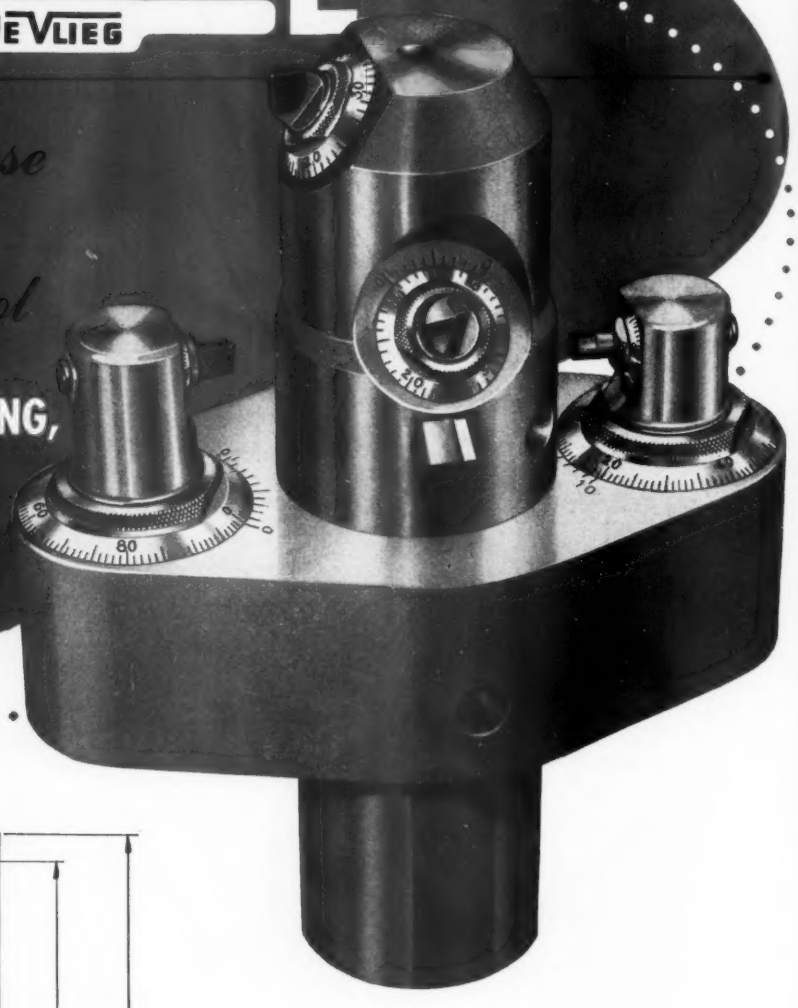

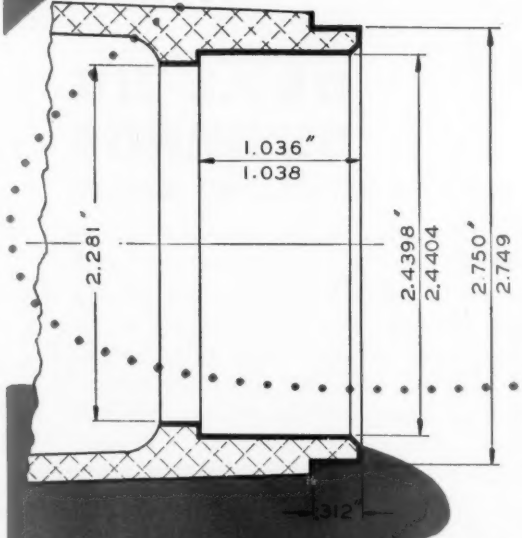

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Illustration shows typical example of cluster tooling using standard Microbore units for machining seven surfaces on a main bearing housing at one pass. Each tool is independently adjusted by proven micrometer vernier principle and precise limits of accuracy are maintained on production runs.

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Automaticity Features New Milling Machines

In a new line of automatic milling machines, just announced by a leading manufacturer, automaticity and manual maneuverability have been combined to an unusual extent for production type milling machines. The new machines are built in plain, duplex, and plain rise-and-fall styles, with a standard table travel of 24". Increased table travels up to 144" can be furnished for long, comparatively light work.

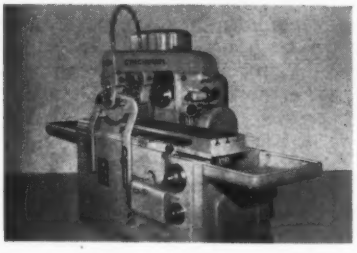

Fig. 1. Plain Automatic Milling Machine

Through a cycle selector unit, a single lever initiates the complete milling operation, including automatic table cycle, automatic spindle stop, automatic backlash eliminator, automatic spindle carrier cycle of RAF machines, and one extra equipment item . . . automatic spindle retraction. To aid in setting up the machine, all these automatic features can be nullified or bypassed for manual control.

An individual motor drives the spindle through V-belts and three gear contacts; 3 hp per spindle for standard spindle speeds, and 5 hp for high spindle speeds. The spindle is quill mounted for cross adjustment. Bearings, gears, and all other parts within the spindle carrier unit are automatically lubricated by means of a combination circulating and splash system.

The walls of the bed are considerably wider than the table, and the intervening space serves to catch the coolant and chips and direct them to a chip com-

. . . *Continued on page 74*

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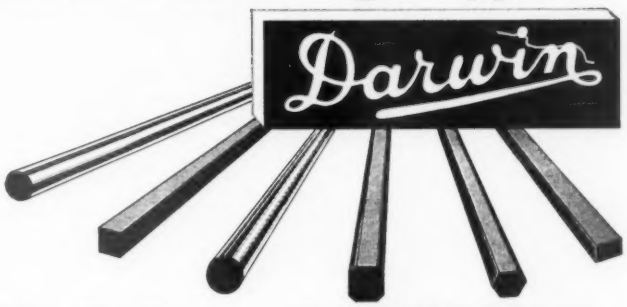

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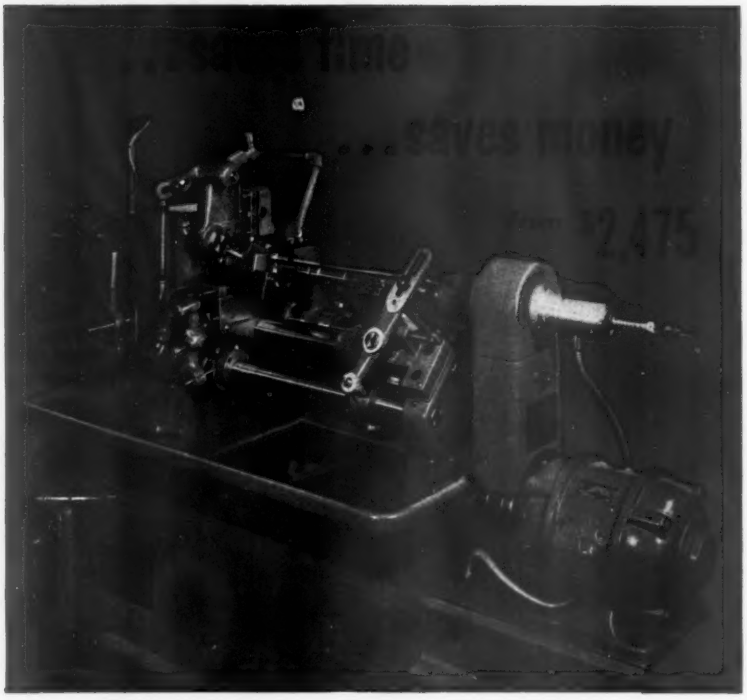


. . . Automaticity, from page 73

Fig. 2. Duplex Automatic Milling Machine

partment in the right-hand end of the bed. This construction, coupled with the rigid coolant pans at the ends of the bed, keeps the floor clean and dry.

Table ways are automatically pressure lubricated with filtered oil, and completely protected against entrance of dirt, chips, and coolant. The standard table is extra long, 55 5/8″ from end to end, affording an extra measure of working area. Dogs are carried on the underside of a rail attached to the front of the table, where they will not be fouled with chips. The table is traversed through a conventional screw and nut arrangement, and powered by a separate 2 hp motor mounted on hinged rails in the bed.

The lever for starting the automatic operating cycle has four power manual directional control positions: rapid traverse right and left, and feed right and left. In the same unit, a second lever controls the vertical traverse of the spindle carrier of RAF machines. It has three positions: "automatic", and "up" and "down" for power manual control.

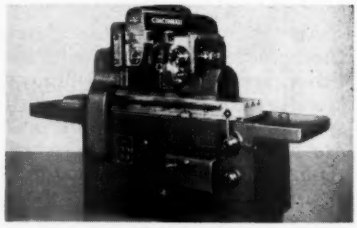


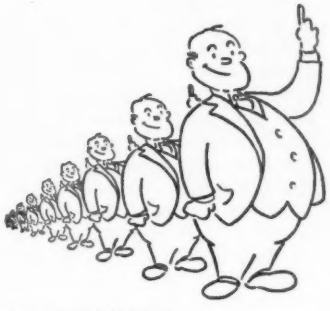
Fig. 3. Plain Automatic Rise and Fall Milling Machine

The sequence of all automatic functions is controlled by the cycle selector, actually an assembly of cams on a rather short demountable shaft in the bed. Dogs control the length of stroke only. Cycle selectors have

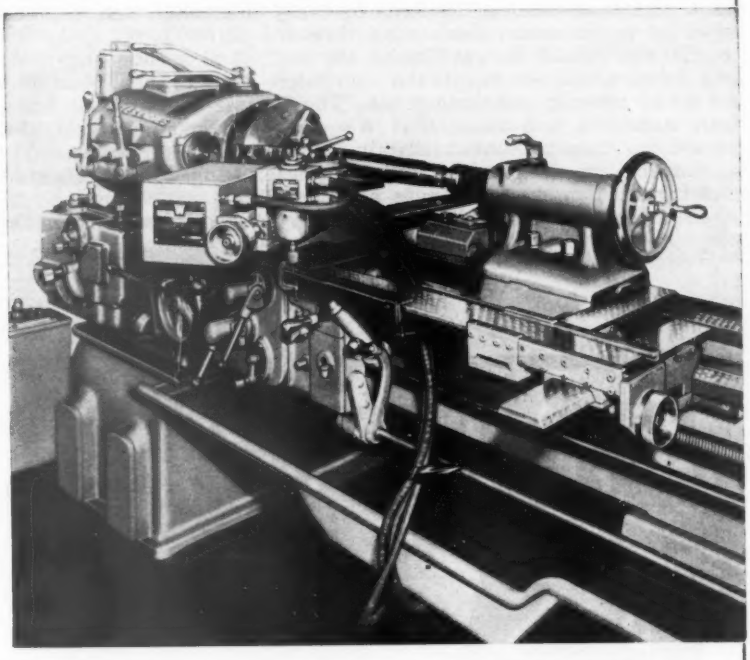
. . . Continued on page 79

TRACER CONTROLLED MACHINING

APPLIED TO THE BOYE & EMMES LATHE



MR. DUPLICATOR



Mr. Duplicator says — "Walker, why can't a simple, understandable Duplicator be built so that operators don't have two strikes against them before they start. Accurate Duplicating cannot be accomplished by twisting screws, using relays, clutches or tubes."

Walker says, "Most designers of Duplicators put everything into them that is in the book, hoping that they will work. One well known company has eight valves between pump and tracer; we have only one. Accurate Duplicating can be only accomplished hydraulically and by Duplicating the form from a template."

The **WALKER HYDRAULIC DUPLICATOR** of Universal Step Turning Design, as shown on the Boye & Emmes Lathe, gives what is most desired. The most compact design, has all of the controls in front with the template, and directly under the finger-tips of the operator.

We replace the standard compound with one of our own design which is more rugged in construction and has a built in hydraulic cylinder. The tracer control valve is mounted on this cylinder by a bracket that has right angle micrometer adjustments. The Duplicating unit can be moved to any selected position that is most desirable to Duplicate the form in the template. The tracer then is adjusted so that its right angle micrometer adjustments can be properly used.

Our Duplicators come on Boye & Emmes Lathes as standard equipment. No one can question that Boye & Emmes builds good lathes and that none are better.

We can place our Duplicators on any lathe already in your shop or any other machine tool that you are desirous of adapting to automatic control to Duplicate uneven shapes from a template. The Hydraulic Duplicator is here to stay and has been built for all machine tools.

Our Mr. Walker is the originator of the Hydraulic Duplicating Attachment for Machine Tools and is definitely an authority on Duplicating procedure. We are the largest manufacturers of Hydraulic Duplicating Attachments for Machine Tools. We have tie-ins with most machine tool manufacturers whereby your new machine can come to you with our Hydraulic Duplicator, if you so desire.

We can furnish a thorough and understandable solution to your Duplicating problems. Send us a print of the part to be made, along with the make and size of machine to be modernized, and we will give you recommendations and firm quotation.

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The New Screw Thread Manual

A most important and necessary handbook, recently published by the American Society of Mechanical Engineers, is the culmination of 50 years of argument, conference and compromise. This book should be among the tools of every draftsman and engineer who, in any manner, deals with threaded screw parts.

Titled "ASME Screw Thread Manual", it is a shop and drafting room abridgement of the American and Unified Standards for screw threads and their gages. The volume contains the American standards and those that were set by the Accord of 1948 signed by Canada, Great Britain and the United States. The agreement was designed to assure the interchangeability of screws and threaded products of those nations.

The simple matter of signing that piece of paper signalled

by George T. Trundle, Jr.
Chairman, Board of Directors
THE TRUNDLE ENGINEERING CO.
Cleveland, Ohio

the success of the efforts of some of the greatest American industrial minds over the half century of dickering and, sometimes, bickering. When, after all the years, the smoke of argument, theorizing and experimenting settled, the arsenal of democracy was strengthened immeasurably.

Many of the men died before their effort bore fruit. Among them are Ambrose Swasey, founder of the Warner & Swasey Co.; Luther D. Burlingame, Industrial Superintendent of Browne & Sharp Mfg. Co.; George Case, chairman of the board of Lamson & Sessions Co.; Stanley G. Flagg of S. G. Flagg & Co.; Col. E. C. Peck, general superintendent of the Cleveland Twist Drill Co.; Edwin M. Herr, president of Westinghouse Electric & Mfg. Co.; Charles M. Manley of Manley & Veal; Frank O. Wells, president of Wells Corp. This is just a short list of the many who worked valiantly and doggedly over the years to accomplish standardization and failed to see its achievement. There are many who lived to see the work become a reality.

With the advent of the North Atlantic Treaty Organization, the work of standardization was carried still further. When the current efforts are completed, a British stretcher will fit the trolleys of an American ambulance, and a Turkish needle will fit on a French syringe. They don't fit now. But they will.

Over The Year's

Serious discussions of standardization were underway for several years when, in 1902, the American Society of Mechanical Engineers appointed a committee to prepare a report on "Standard Proportions for Screw Machines". The five year task of that committee was crowned with success when the report was adopted at the society's convention of May, 1907, at Indianapolis.

Many companies endorsed the standards and informed Ameri-

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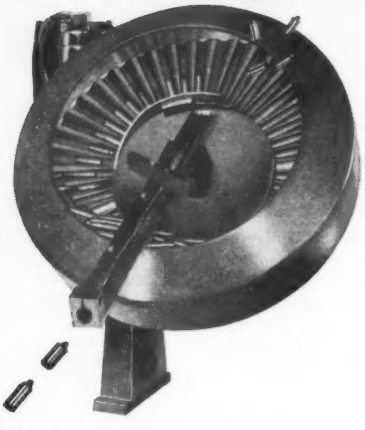

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DETROIT POWER SCREWDRIVER CO.
2827 W. FORT ST. DETROIT 16, MICH.

can industry that they would be ready to fill orders based on those standards as soon as the gages were ready. The latter were being manufactured by a company which years later was to make history in the field of aviation engines, Pratt and Whitney.

As the years progressed many other technical groups joined with ASME in the efforts to achieve American standardization and later international agreement on threaded parts. Foremost of these groups are the Society of Automotive Engineers, the U. S. Bureau of Standards and the Departments of the Navy and Army, Bridge Builders and Structural Society and the Machine Screw Manufacturers Association.

Standardization began to sweep the American industrial scene, but as yet there was no international agreement. In 1908 an ASME committee headed bv E. M. Herr went to Paris at the invitation of the Societe des Industries du Gas for discussion of standardization. Another letter suggesting international cooperation was received from Dr. I. G. Schleisinger of Germany. His note suggesting standardization of screw thread systems is dated October 8, 1912. That letter, now in the ASME archives, was received a year and a half before the Allied nations learned their first costly lesson.

World War I gave tremendous impetus to the move for international cooperation. The difficulties the Allies experienced in repairing each others' equipment again started the agitation for international unification of thread standards.

American standardization, however, was progressing rapidly. In October, 1916, the Navy Department accepted the standards for machine screws of ASME. The five and one-half year task of the society's committee on Tolerances in Screw Thread Fits was adopted and published in February, 1918.

Many years were to pass before complete American Standardization was achieved. Many motorists can remember the days when the shearing of a bolt caused undue delay because it was difficult to find another to fit the nut. There was many a blacksmith pressed into service to shape a fastner to replace parted nuts and bolts.

International progress was far slower. Despite the serious lessons learned during World War I, no progress was made between the one-time Allies. The United States and Great Britain were still separated by the five degree difference in the screw thread angle with the former clinging to the 60 degree angle.

The first break in the international stalemate came in 1926 when a British mission visited the United States and brought with it the compromise proposal of a 57½ degree thread angle. This squarely split the five degree difference. But American refusal to alter its now established angle brought the work of the mission to a fruitless end.

And the two countries continued to go their separate ways. No other international attempts were made by the United States or any other country. And the bitter lessons of that first great international conflict soon were to haunt the allied nations again. American standards were a reality, but the international lessons were to be learned again.

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With the coming of World War II, the United States poured billions of dollars worth of material into the hands of the British, French and other Allies. And once again there was the problem of replacement parts for repairs. British industry was not geared to turn out threaded screw parts and tapped parts to fit American machines. So millions of dollars worth of parts were crowded onto the already over-burdened Liberty ships to be hauled to combat areas and into the heart of the British arsenal.

Once again the cry for unity was heard. By December, 1943, two years after the United States was at war, the first of the new series of international conferences took place in New York. A second round of conferences followed in London during August and September of the next year. A third meeting was held at Ottawa, Canada in October, 1945.

The war was over and once again the specter of the costly failure to unify screw thread standards, tolerances and fits rode through the United States, Canada and Great Britain. At that Canadian conference, the British agreed to adopt the American screw thread angle of 60 degrees and proposed what later became known as the Ottawa thread form.

However, American objections remained to crest and root contours. But the basic differences had been resolved and each nation then was permitted to follow its own preference since the products would enjoy interchangeability.

The work thereafter was carried on by small conferences between three nations on the computation of tolerances, and allowances for all diameters (major and minor) and pitch of external and internal threads. That work lasted into the fall of 1948. In November of that year, the most important industrial pact ever written was signed. It was the Declaration of Accord and to it was affixed the signatures of govermental and industrial representatives of the three nations. That accord declared that the three nations:

Agree that the standards for the Unified Screw Threads given in the publications of the Committees of the British Standards Institution, Canadian Standards Association, American Standards Association, and the Interdepartmental Screw Thread Committee fulfill all the basic requirements for general interchangeability of threaded products made in accordance with any of these standards.

And all that effort, the years of frustration, the discord of nations, and then the final agreement is summed up in the tables on the pages of a book which, in its appearance, fails to reveal all the turmoil that had gone before.

This is the work that unifies and strengthens the arsenal of democracy and is the guide to the work of draftsmen, engineers and of commerce and industry. It is a "must". It is hoped that this monumental work clothed in its modest binding and cover will find its place at every drawing board and in every shop throughout the country.

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Write Dept. E for Hitch Feed Catalog and interesting information on how they've been applied.

H. E. DICKERMAN
MANUFACTURING CO.
323 Albany St., Springfield, Mass.

. . . Automaticity, from page 74

been designed for almost every conceivable automatic cycle. They may be changed in less than a minute's time when changing setups. To further reduce the user's inventory of cycle selectors, the No. 2-24 machines are equipped with a table cycle reverse device. This consists of a knob extending from the front of the bed, and changes the direction of table feed and rapid traverse from right to left and vise versa. A small external control lever, operated with the forefinger, serves as a setup convenience for indexing the cycle selector.

Automatic table cycles feed right or left, or alternately right and left with a center stop position for safety. Rapid traverse is at the rate of 300″ per minute. Sixteen table feeds, ranging from ½″ to 20″ per minute, are obtained with change gears. To protect the operator, the gears stop rotating when the hinged cover over the feed change station is opened. This is accomplished through an electrical contact button in the electrical circuit.

Twenty spindle speeds range from 30 to 1200 rpm. They are obtained through change gears and an externally operated back gear. The spindle speed change station is also equipped with a safety contact button to protect the operator, should he forget to shut off the electrical current before changing gears.

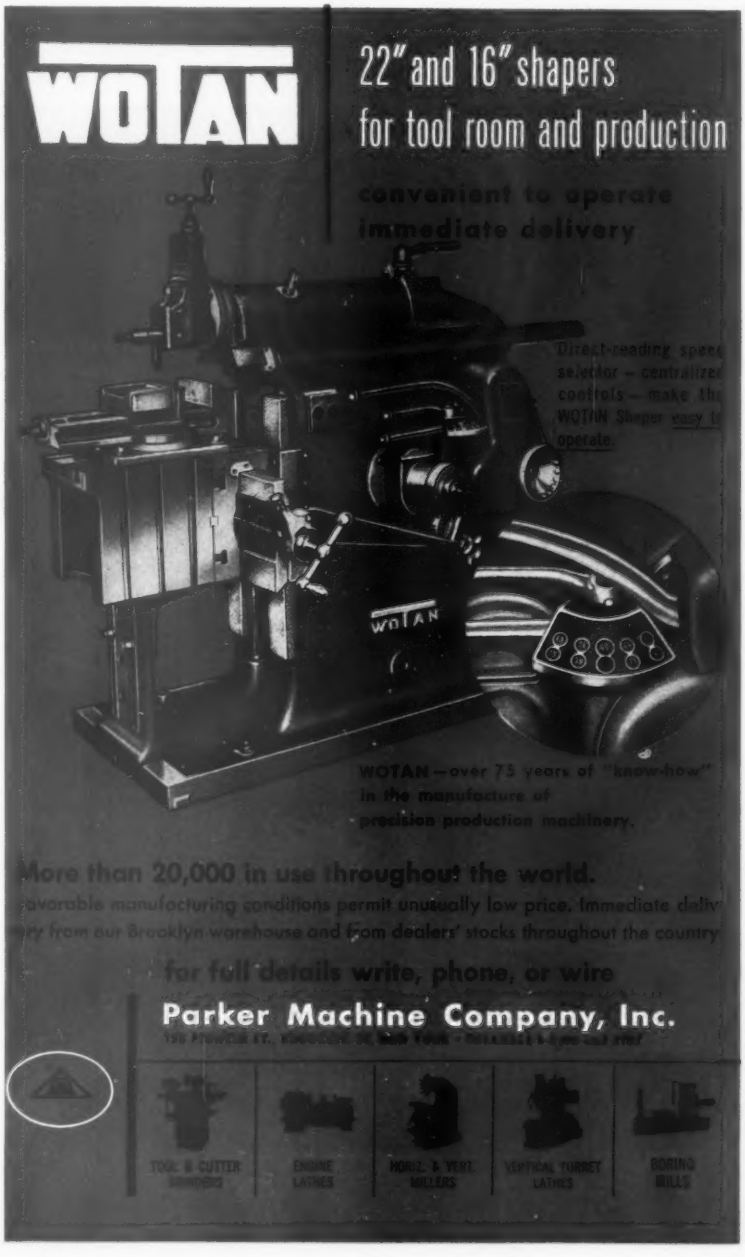
Vertical feeds for the spindle carrier of RAF machines are infinitely variable from 1″ to 40″ per minute, obtained through a dial control. Feed cycles are initiated and synchronized with the table cycles by the cycle selector unit, described in the previous paragraphs. Adjustable stops, engaging the teeth of a fixed rack, may be set to utilize any portion of the 8″ vertical range. The standard RAF machine feeds down only, and rapid traverses up and down at the rate of 100″ per minute. However, the machine can be arranged to feed up and down for box milling.

A built-in automatic backlash eliminator device for the table feed screw is also actuated by the cycle selector. It is engaged during the vertical feed cycle and while the table traverses at a feed rate, and automatically disengaged at other times.

Another built in feature, the automatic spindle stop, safeguards the operator while loading and unloading the fixture. This feature, too, is controlled by the cycle selector. In addition, a manual control is provided to disengage the automatic function.

Electrical control equipment is assembled by the company into accessible, self-contained units designed for the machine. The door of the control unit is equipped with a built-in, mechanically interlocked disconnect switch. A push-button panel on the front of the machine bed contains a small light bulb to visually indicate the effectiveness of the hydraulic oil filter, conventional start and stop buttons.

Extra equipment available for these automatic milling machines includes automatic quill retraction. Just before the return stroke of the table, the spindle automatically retracts 1/32″. In both advanced and retracted positions, the spindle is automatically clamped.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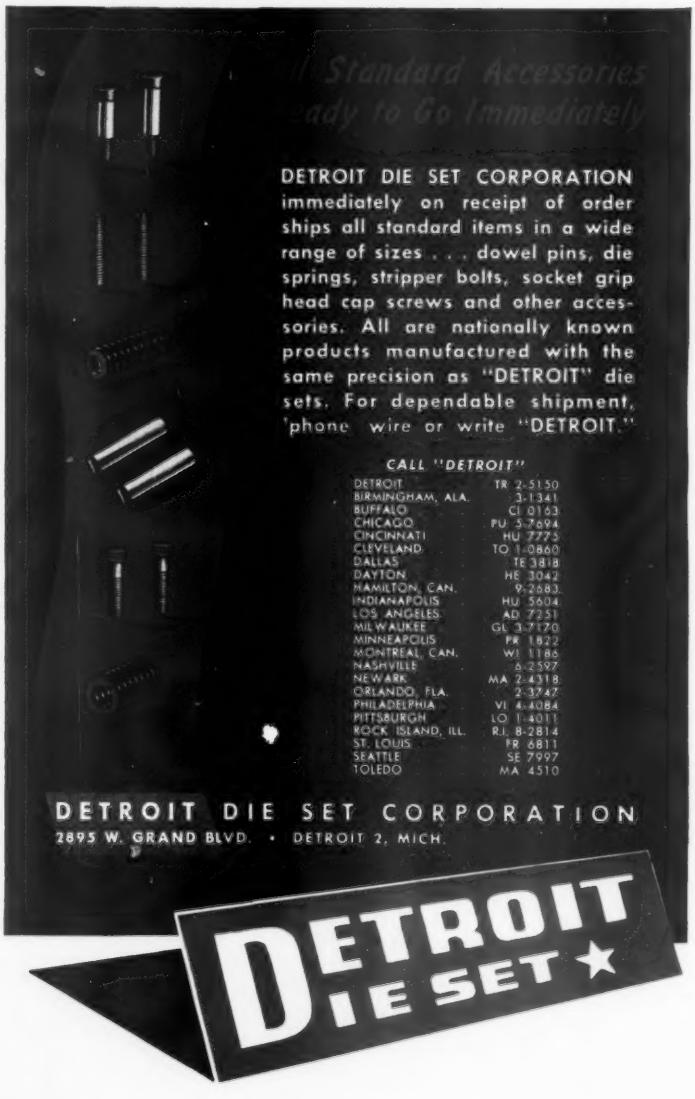
PRESCRIPTIONS FOR PRODUCTION

. . . put up by W. N. ("Doc") Nordquist, Technical Editor

Large sheet metal sections requiring extreme compound curvatures and basically suitable for stretch-wrap forming can now be pre-shaped to match the vertical die contour, by means of hydraulic multiple-jaw setup that features extreme flexibility. Jaws are loaded with flat metal, then bend the metal as necessary along its full length, and hold this curvature while wrapping it around the vertical contour-forming block.

Now you can add to economy base metals a brilliant white finish of unusual beauty, high hardness, and non-corrosive qualities. A new method of applying rhodium plating in thicknesses as great as 0.001" is especially applicable to instruments, optical goods, process equipment, and so on.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DETROIT DIE SET ★

A leading Midwest supplier of stampings and of die components has developed a process for low-cost production of small multi-pierced stampings, flat or flanged. Process utilizes floating punches, horizontal reciprocating die, maximum standardization, automatic cycling, and press modification. Process fills the gap between single-hole piercing and conventional permanent gang dies, will be good for short runs in excess of 3000 pierced openings. Now available as contract-stamping service only.

Coolant oil can be recovered from mist and smoke generated by high speed machining operations. Precipitron oil mist control unit also provides clean atmospheric conditions that improves operator attitude and consequently his performance. Unit is completely self-contained.

Hydraulic pressure compensating control, giving smoother operation and elimination of erratic motion due to pressure variations, is offered by new multi-range hydraulic flow control. Valve utilizes 2-way adjustable orifice design, provides for 100% regulation of flow within a given range but allows optional choice of ranges. Unit may substitute, in some instances, for variable-delivery pump.

Carbon soldered to metal? Yes. Electrical equipment manufacturers can now have brushes, contacts, friction pads soldered directly to metal parts. Eliminates parts, saves production time.

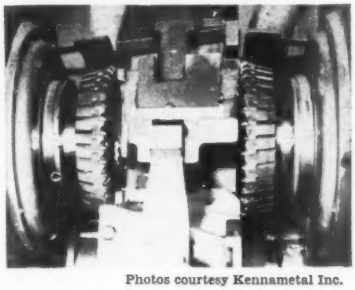
Diamond abrasive now comes, from one supplier, packaged in a plastic cartridge instead of glass. It was found that abrasive occasionally became contaminated by minute glass chips from opening the cartridge. New plastic cartridge will not break or crack if dropped, offers greater protection for valued contents.

A major producer of large press brake bending dies is now making them from a pre-hardened, free-cutting steel. Dies take and retain a smoother finish, require less pressure for bending, last longer. They are especially useful in bending high tensile strength.

New line of universal jaw clamps will, in many instances, eliminate U-clamps, straps, and fingers, will hold rigidly against flat surfaces. Clamps feature faster setup (one adjusting screw to position and hold work), stronger grip (5-ton holding force), less obstruction (clamp can be fully passed over, only 1" above machine face).

Carbide Milling Cutters Increase Production, Reduce Down Time

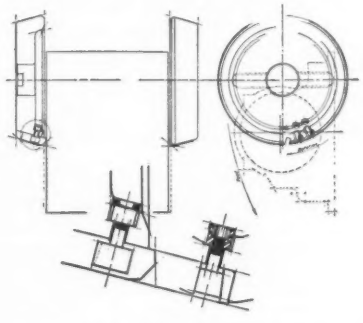
Straddle milling 3500 cast iron automatic transmission gear cases per tool grind is being performed on a 20-horsepower Davis Thompson drum-type mill using two units for rough mill-



Photos courtesy Kennametal Inc.

ing and two for finish milling. These four 12-inch diameter cutters are axial face Kennamills. Each having 36 solid blades of Kennametal, they are run at 26 inches per minute feed rate, 0.009-inch feed per tooth, 250 surface feet per minute at 80 revolutions per minute. Average depth of cut for the roughing cutters is 3/16-inch on each side. For the finish cut about 1/32-inch of stock is removed per cutter.

Under similar operating conditions, 3000 to 3500 pieces may be straddle milled before cutters require any regrinding. Reconditioning time per cutter is only one hour. Resharpening consists



of diamond finishing both corner and face angles on the solid tungsten carbide blades. Snagging and roughing usually required on brazed tooth cutters are eliminated.

Kennamill bodies are rugged in construction for heavy cutting, yet simplified in design for quick shop maintenance. Only four parts make up the cutter: Body, blades, wedges, and nuts. These mills have three blades per inch on 8-inch diameter and wedged-in, free from brazing larger units. Blades are solid strains. Wedge screws are one piece hardened alloy steel pulled up tight with readily accessible Allenuts. There are no threads in the cutter body.

Mill Set Up As Versatile "Two-in-one" Cutter

In another interesting instance, a large steel plant uses Kennamills as "two-in-one" cutters. They formerly milled flats on the 13-inch diameter journals of their 22-inch diameter steel work rolls (35 to 40 Scleroscope) with a high-speed steel inserted-tooth cutter. Since this type of cutter has to be run at a lower speed and feed, it required eight hours to mill two flats per roll. Same job is now processed in only one hour with a 12-inch Kennamill, having twenty solid

. . . *Continued on page 152*

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FIXTURE CLAMPS AND FIXTURE DETAILS!
BACKED BY 30 YEARS OF FINE TOOL MAKING AND NATIONALLY USED AS STANDARDS
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Highest quality of workmanship and materials maintained at all times.
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MEN YOU SHOULD KNOW . . . . . .

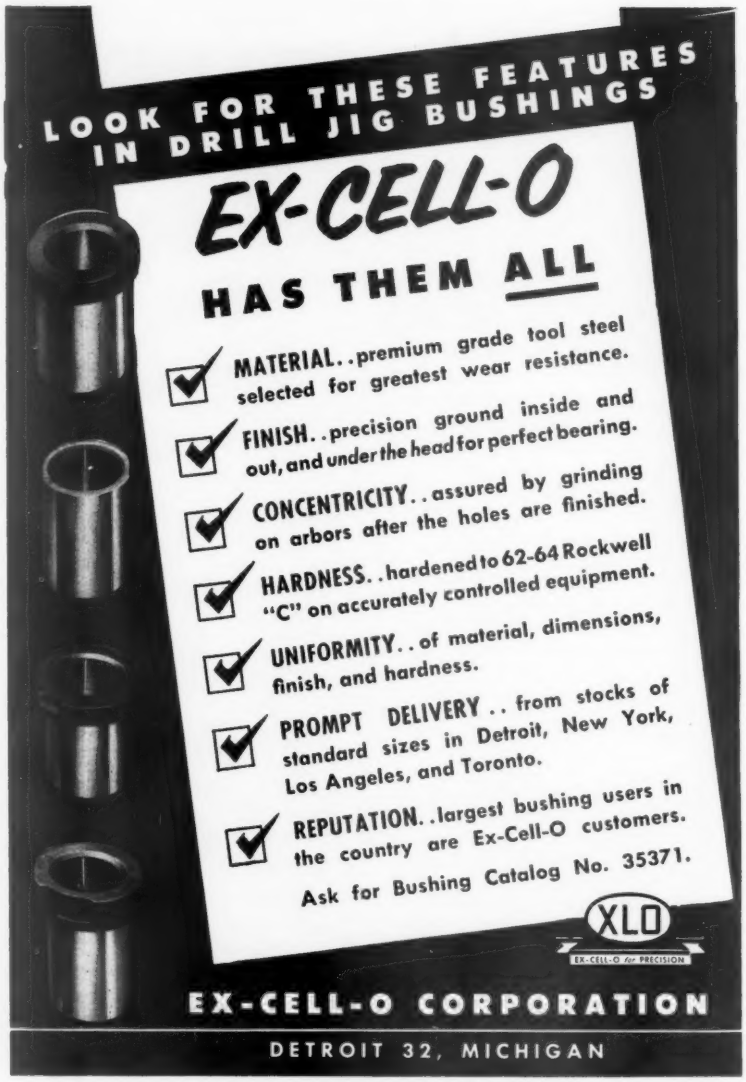
A. Donald Kelso

John Jeppson

Howard J. Daly

Robert G. Morgan

Robert L. Williams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HAS THEM ALL
MATERIAL.. premium grade tool steel selected for greatest wear resistance.
FINISH.. precision ground inside and out, and under the head for perfect bearing.
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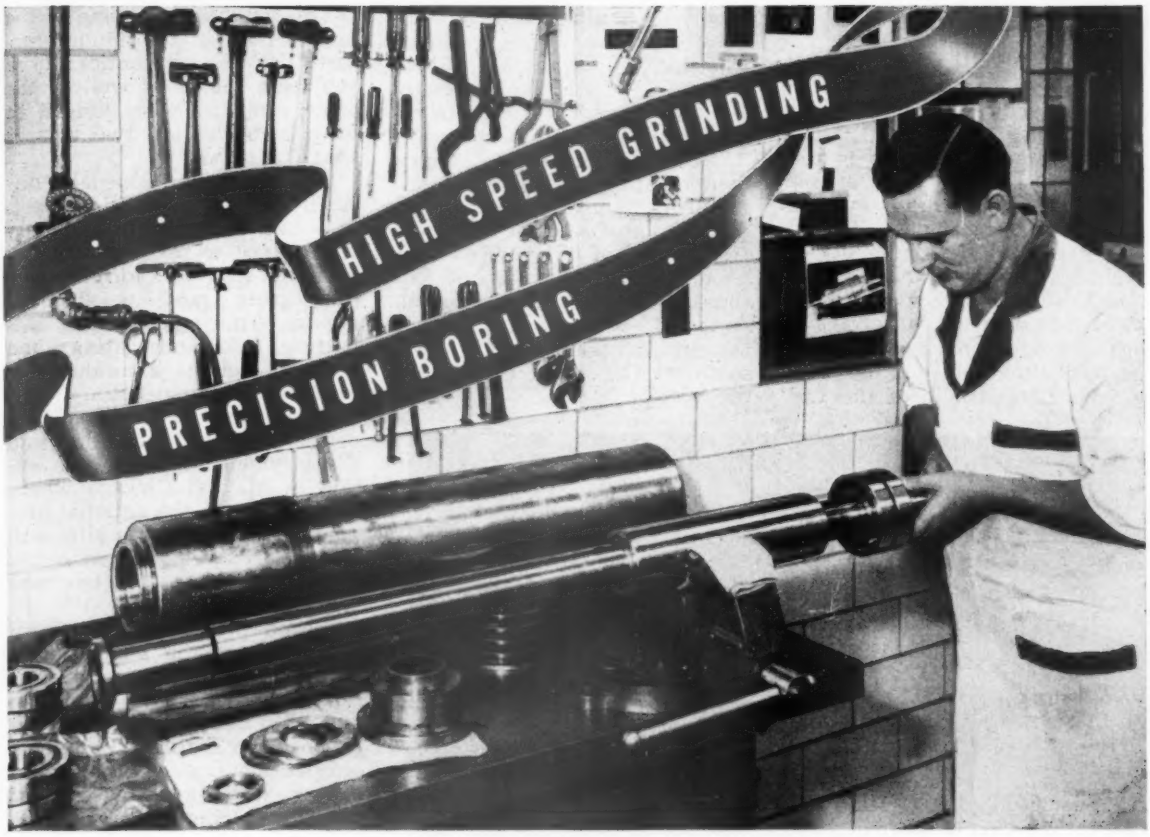
Four promotions followed Norton Company's recent annual Stockholder's meeting. A. Donald Kelso, president of Norton Behr-Manning Overseas, Inc., since last October, became a Norton Company vice president in charge of foreign operations and a director, while retaining his former position. John Jeppson, formerly assistant secretary and works manager, was appointed vice president. He remains as works manager of the Abrasive Division. Howard J. Daly, manager of Bauxite and Crude Abrasive plants, was elected to the board of directors. Richard Prouty, formerly assistant to the treasurer, was appointed assistant secretary of the company. George N. Jeppson and Milton P. Higgins were re-elected chairman of the board and president respectively. Mr. Jeppson begins his 61st year with the company.

The appointments of Robert G. Morgan to the post of district manager, Moline, Illinois office, and of Robert L. Williams to that of district manager, St. Thomas, Ontario office were recently announced by the general manager of the industrial division of the Timken Roller Bearing Company. Morgan, who joined the company in 1937 as an engineering trainee, assumes his position after a variety of executive posts. Williams has been with the company since 1938, except for a stretch with the Navy. Both men are graduate mechanical engineers, Morgan having graduated from Penn State and Williams from Case School of Applied Sciences.

Carl E. Schmitz has recently been appointed vice president



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Winning Foundrymen

Two Los Angeles AiResearch Manufacturing Company apprentice moulders won the first and second prize honors in the national moulding contest for apprentices sponsored by the American Foundrymen's Society and judged by the University of Illinois. This was announced today by Joseph E. Foster, technical assistant of the Society.

Top award winner with a near perfect aluminum casting was Joseph Lo Patriello of the Los Angeles aircraft component company and second prize winner was his fellow worker, Carlo Gonzales. Both had already won the southern California regional contest in the same order.

Using the standard foundry equipment of AiResearch Manufacturing Company, the two apprentices produced the most perfect casting of all those entered from the U. S., Canada and European countries according to Anthony Tuzzolino, chairman of apprentice training for the southern California chapter of the Society.

This was the first time in the long history of the annual contest that two apprentices from the same region as well as the same company were judged to have won the top two awards said Tuzzolino.

Given the same unusually difficult pattern that all contestants had to duplicate and only one chance to make it, the AiResearch moulders formed their own green sand, wood flask mould, determined their own parting line and gating, and poured molten aluminum to form the winning castings.

Lo Patriello wins an all expense trip to the American Foundrymen's Society convention in May at Chicago where he will receive the national first place certificate and a $100 cash award. His regional prize had been a complete tool box and and $25 in cash.

Second prize in the national contest earns the second place certificate for Gonzales who already had won moulding tools and a $15 cash award for second place in the southern California competition.

Both winners received their entire moulding training under the apprenticeship program of Frank Warga, foundry general foreman of AiResearch Manufacturing Company. Last year's winner of the southern California regional contest was Ray Miles, another Warga trained AiResearch apprentice.

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Compared to our old offices, the new place (pictured above and right next door to the old) is really fancy. Yes, it's quite an improvement and the cheerful surroundings seem to help us serve our customers better. If you're looking for a source for good steel treating and friendly, dependable service—the number to call is HEnderson 1-6601.

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Dayton Distributor For Scully-Jones Tools

One of a number of stocking distributors recently appointed by Scully-Jones and Company, Chicago, Illinois, is Dayton Supply & Tool Co., 520 E. First Street, Dayton 1, Ohio. These distributors, who will carry local stocks of Scully-Jones precision holding tools, are being named to facilitate improved service to industries in their sections.

Dayton Supply & Tool will cover Dayton, Springfield, Piqua, Middletown, Hamilton, Sidney and Mechanicsburg, Ohio.

The Chicago firm has been designing and manufacturing precision holding tools since 1912, including drill and tap chucks, floating holders, adjustable adapters, recessing tools, quick-change chucks, standard milling machine arbors, lathe centers.

Sharp Upswing in Shell Molding is Forecast

A marked upswing in production of phenolic resin for the foundry industry's shell molding process, that will continue through and beyond 1957, has been forecast by the nation's leading manufacturer of this product.

Robert K. Mueller, general manager of Monsanto Chemical Company's Plastics Division, estimates that recent revolutionary developments in casting procedures virtually assures an eventual industry-wide production volume in phenolic resins that will be nearly 17 times 1952 figures. Resins used in the shell mold process have more than doubled each year since their first major use in 1950, and now are produced at a rate of several million pounds annually. The plastic is used to bond a new, thin, strong, sand shell for castings that means substantial savings in capital investment, floor space, machining or finishing, and sand handling as well as greater precision in casting. "The universal appeal of the shell mold development is indicated by its growing use in both large and small foundries," Mueller said. Two of the largest foundries in the world have adapted operations to it.

While the percentage of the total number of foundries that have installed shell molding machines is small, the success of the process is clearly demonstrated by the backlog of orders for equipment. Orders cannot be filled by machinery manufacturers for three to six months. It must be remembered that very few shell molding machines were in operation in 1951. Last year showed a sharp growth with 20 foundries in actual production and more than 100 beyond the development stage but forced to wait for machines or patterns.

Probably a better measurement of the 1952 expansion would be the number of molding stations in operation. Most shell molding units are multiple station machines, varying from two to 24. Approximately 300 stations were making shells for castings last year. By the end of 1953, the number of stations should be three times those in operation today.

Early beliefs that the size and weight of parts would be a limiting factor in the application of shell molding have been shattered. A 300-pound casting for railroad use has been cast successfully by one foundry. Another is using the shell mold process to cast 175-pound parts regularly. And the vast quantities of tiny metal products now cast in sand and resin shells cannot be ignored.

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Ground Machined Steel Plates and Discs. We furnish plates and discs in any size or shape cut to your requirements in thicknesses from ¼" to 6". We Blanchard Grind up to 84" diameter.
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Computing Air Gage Indicator

The original application of air gaging was for the checking of internal and external diameters. However, as its advantages became more apparent, air gaging was applied to multiple and complex measuring problems such as checking of tapered cylindrical parts, center distances, squareness between face and bore, concentricity, etc.

Whenever the air gage is used for one of these measuring problems, the gaging set-up is complicated by the fact that there is always more than one variable involved, since the readings are not only affected by variation of the above factors, but also by variations in diameter. Since the total effect of both variables must be considered in arriving at the final result, it is necessary to use at least two air circuits and a like number of indicators in order to arrive at the desired result. Furthermore, to resolve the problem fully, the operator frequently has to take readings from two air indicators, such as shown in sketch No. 1, then add or subtract the respective readings before the final answer can be obtained. This computation is required when checking tapered parts, center distances between holes, and clearances between mating parts.

Photo courtesy The Taft-Pierce Mfg. Co.

When checking concentricity between diameters or squareness of bore to face, it is not usually necessary to obtain results from separate indicators and then compute an answer, but, due to the usual permissible variation in diameter involved, the position of the tolerance range on the scale will change, if the diameter varies from its mean value.

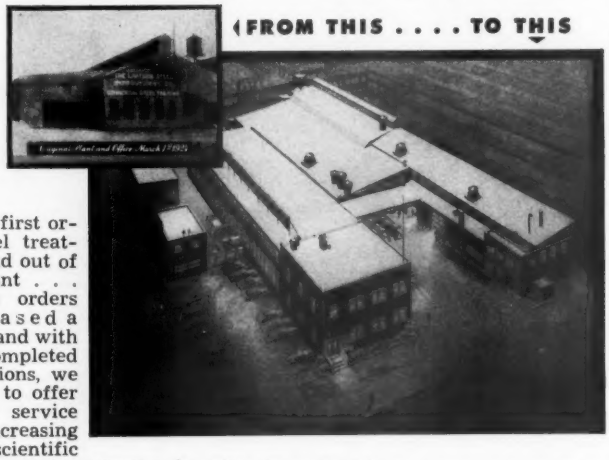
From the foregoing discussion, it can be seen that when applying the standard type of air gage circuit and indicator to these measuring problems, some of the value of air gaging has been lost, since more responsibility is placed on the operator and the human element has not been entirely eliminated.

Through the use of the computing indicator illustrated, it is possible to remove the effect of one of the variables (diameter) on the results shown by the indicator for value of angle of taper, concentricity, clearance, by applying the diameter variation to both sides of the differential measuring device, thereby nullifying its effect on the reading obtained on the dial. In this way it becomes possible to obtain readings for these dimensional characteristics on a single dial with a single pointer.

While it is still too early to judge the full effect of its impact on production gaging, it is clear that it will open the way for new thinking on gaging problems and far wider air gage utilization throughout industry.

...there is a Reason!.... When You Grow

(FROM THIS .... TO THIS



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Carl E. Schmitz

Gifford Kittredge

Hans K. Reitz

O. W. Acheson

Francis J. Sehn

in charge of sales for Crane Packing Company, Chicago, formerly holding the position of vice president and director of engineering. He joined the company in 1942, since which date his duties have been with the engineering department.

Lamson Corporation, manufacturers of conveyors, pneumatic tubes, automatic pallet loaders and blowers, announces the appointment of Gifford Kittredge as New York regional manager. He will head the New York, Baltimore and Philadelphia districts. Mr. Kittredge is a member of the Midwest Material Handling Assoc. O. W. Acheson has been appointed manager of manufacturing. He previously headed the blower division, and has a wide background of many years in industrial manufacturing and distribution as well as production experience. Mr. Acheson is a member of many foremost civic and industrial associations.

Appointment of Hans K. Reitz as factory manager was recently announced by the president of Colonial Broach Company, Detroit. Reitz served his apprenticeship in Europe before joining Fisher Body Division in 1928. He worked for Graham-Paige and Chevrolet motor companies before joining Colonial in 1940.

Francis J. Sehn, former Detroit district sales engineer for the Clearing Machine Corp., has been appointed vice president in charge of sales of the Sahlin Engineering Company, Birmingham, Michigan. He was previously associated with E. W. Bliss Company as sales engineer and with Fisher Body Div.

NEW

INDIVIDUAL VULCANAIRE DUST COLLECTING UNITS

Are used on surface and other grinders where grinding dust must be removed.

Inexpensive, compact units, with no moving parts. Operated from your present air supply.

Installed in a few minutes, eliminating need for costly centrally located dust collecting systems.

The collector element is mounted on the side of the machine. Quickly cleaned, requiring no refills.

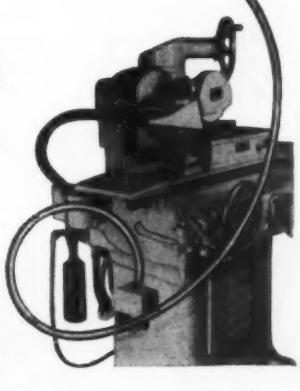
Vac-suction pick-up device (vacuum nozzle) is mounted on the grinding wheel guard or close to grinding wheel on other applications. This mounting permits constant contact with dust as the wheel is moved up or down.

A simple needle valve operates the unit, and can be shut off whenever the machine is not in use.

Available in two sizes: 700 series for grinding wheels 7" dia. or less—200 series for wheels 2" dia. or less.

Made by the makers of Vulcanaire *The* jig grinding attachment.

Write on your letterhead for "Dust Collector" Booklet.



VULCAN TOOL CO.

PRITZ ST., DAYTON 10, OHIO

Keep Informed • CATALOGS BULLETINS • SPECIFICATIONS

PUBLICATION

New "Spacemaker" Air Cylinders by Tomkins-Johnson Co., Jackson, Michigan, save up to 40 per cent space with new streamlined design that improves rigidity and strength and at the same time eliminates tie rods. Solid steel heads and heavy wall seamless steel body. Other advanced features are described in bulletin 8152 from the company.
Circle Inform-A-Gram No. B1.

New Header Die Manual Tells How to drill assemble, and finish series HN rough-cored header die nibs employed by the Carboloy Dept. of General Electric Co., Detroit 32, Michigan. Also data on nib standards, heading die design, shop equipment and other data for preparing nibs and other header die casings.
Circle Inform-A-Gram No. B2.

Press Production Increase of More than 500% is possible with the "Rol-di-Feed" from H. E. Dickerman Mfg. Co., Dept. H23, Albany St., Springfield, Mass. Longer die life between regrinds, reduced rejects.
Circle Inform-A-Gram No. B3.

Movable Differential Scale System is feature of Mora precision height gage by Brand Tool & Supply Co., 907 S. Victory Blvd., Burbank, Calif. May also be used as dial indicator and dial platform gage. Full data and prices in current literature.
Circle Inform-A-Gram No. B4.

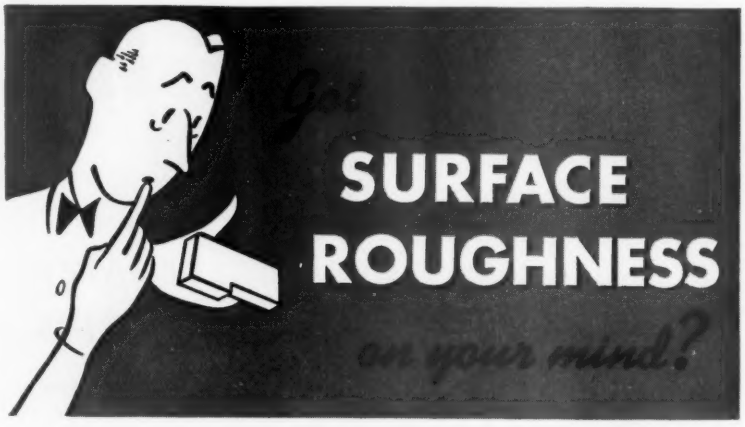
Compactness and Capacity are combined in "Burgmaster Tapper" by Burg Tool Mfg. Co., 3743 Durango Ave., Los Angeles 34, Calif. Range #10 — ½" NF. Rubber flex chuck, rugged construction. Data from maker.
Circle Inform-A-Gram No. B5.

Carbide Tools by Kennametal are especially designed for heavy duty tracer turning with hard-to-machine metals. Turning time has often been reduced as much as 80 per cent after replacing standard tools with them. Performance studies and other data sent on request to Kennametal Inc., Latrobe, Pa.
Circle Inform-A-Gram No. B6.

Fast, Free, Scratchless Cutting is done by a new honing stone by Scientific Abrasives, 5100 N. Canfield Rd., Chicago 31, Ill. It is tough and resilient, may be drilled and tapped and formed to shape an abrasive wheel.
Circle Inform-A-Gram No. B7.

4 & 5 Ton Punch Press by Kenco Manufacturing Co., 5211 Telegraph Rd., Los Angeles 22, California, has low first cost and many better-than-competitive features. New bulletin has all details on the complete line. It is claimed that these presses will outpunch any 7½ ton press.
Circle Inform-A-Gram No. B8.

Carbide Tool and Cutter Grinding can be speeded with "XL" bond wheels, much outperforming conventional silicon carbides. Eng'g data from Chicago Wheel & Mfg. Co., 1101 Monroe St., Chicago 7, Ill.
Circle Inform-A-Gram No. B9.



Then you'll want FREE BULLETIN L21. It tells . .

- **How to establish roughness specifications**
  — for parts in production, and
  — for parts of new design.
- **How to show roughness specifications** on working drawings and shop prints.
- **Practical benefits** gained by specifying surface roughness.

This bulletin also defines "surface roughness." It gives practical pointers on MEASURING surface roughness in the shop — and briefly tells why most plants use the PROFILOMETER for doing this.

Write today for your free copy. Ask for *Bulletin L21.*

Profilometer is a registered trade name.

MMCo
MICROMETRICAL
MANUFACTURING COMPANY
345 S. MAIN ST. ANN ARBOR 15, MICHIGAN

PREVIEWS

Circle postage-free Inform-A-Gram Key Number for your request

56 Pages of Air Power Applications are contained in the latest catalog from Mead Specialties Co., Dept. P-32, 4114 N. Knox Ave., Chicago 41, Ill. Shows many applications of different attachments and devices designed to make your operation more efficient and less costly.
Circle Inform-A-Gram No. B10.

Rotary Tables, Universal Dividing Heads, high precision angle iron blocks and precision die sawing and filing machines are all briefly described in a catlalog sheet from Cedar-West Tool Co., Inc., 90 West St., New York 6, N.Y.
Circle Inform-A-Gram No. B11.

Whiteprinting Outfits for Plants, Offices and Schools are described in literature now available from Peck & Harvey, Inc., 5736 N. Western Ave., Chicago 45, Ill. Full process description is supplemented by suggestions for printing and developing with speed, economy, and utility.
Circle Inform-A-Gram No. B12.

New Profilometer Catalog from Micrometrical Mfg. Co., 345 S. Main St., Ann Arbor, Michigan, gives full data and operating instructions on the line of surface toughness measuring equipment and attachments now put out by this company.
Circle Inform-A-Gram No. B13.

Carbide Tools, Tips, and Blanks are featured in one of the latest catalogs from the DoAll Co., Des Plaines, Ill. Contains grade comparison charts, chip control data and full ordering information. Bulletin 52-817.
Circle Inform-A-Gram No. B14.

Stamping Presses are described in current 16-page catalog from Verson Allsteel Press Co., 9335 S. Kenwood Ave., Chicago 19, Ill. Condensed specifications and data are given on a complete line of presses and special machines.
Circle Inform-A-Gram No. B15.

Airless Blast Cleaning in the nonferrous foundry is described in new bulletin 904 from American Wheelabrator & Equipment Corp., 1183 S. Byrkit St., Mishawaka, Indiana. Case histories cover cost reductions effected in brass, bronze, aluminum and allied fields.
Circle Inform-A-Gram No. B16.

Inaccurate Center Holes affect the accuracy of each subsequent machining operation in cumulative stages. The latest center lapping machine by Ex-Cell-O Corp., Detroit 32, Mich., will easily eliminate any possibility of this occurring. Bulletin 40271 has all machine specifications and operating and application data.
Circle Inform-A-Gram No. B17.

Standard Twin Wheel Tool Grinder has two front approach cup wheels mounted side by side, one for finish and one for rough grind. Production is increased, grinding time cut as much as 30 per cent. Bulletin TW from Standard Electrical Tool Co., Mt. Hope & Sixth Sts., Cincinnati 4, Ohio has complete data and specifications.
Circle Inform-A-Gram No. B18.

How to Straighten Flap Tracks

Precision parts for aircraft call for the use of precision equipment.

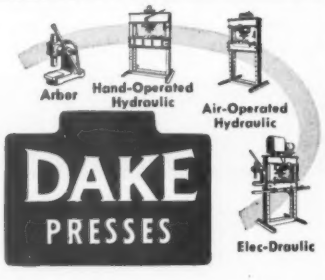
These flap tracks, machined from 4130 steel (aircraft quality), must be checked on a straightening press four times during fabrication. For ease of control and accuracy, the work is done on Dake Gap Type Presses like that shown in the photograph above.

To the right of the ram, the operator has placed a rule gauge which indicates ram travel. Knowing the elasticity of the piece being tested, he can estimate the overtravel necessary to straighten the piece with a single movement of the ram.

Dake Gap Type Press broaches boring bars

Dake Gap Type Presses are available for straightening or forcing, in 22 models ranging up to 300 tons capacity. They are fully described in Bulletin No. 299—sent on request.

Dake Engine Company, 634 Seventh St., Grand Haven, Mich.



Send for Big New Catalog

DAKE ENGINE COMPANY
634 Seventh St., Grand Haven, Mich.
Please send me a copy of Dake Catalog No. 129
Name _____
Company _____
Address _____
City _____ Zone ____ State ____

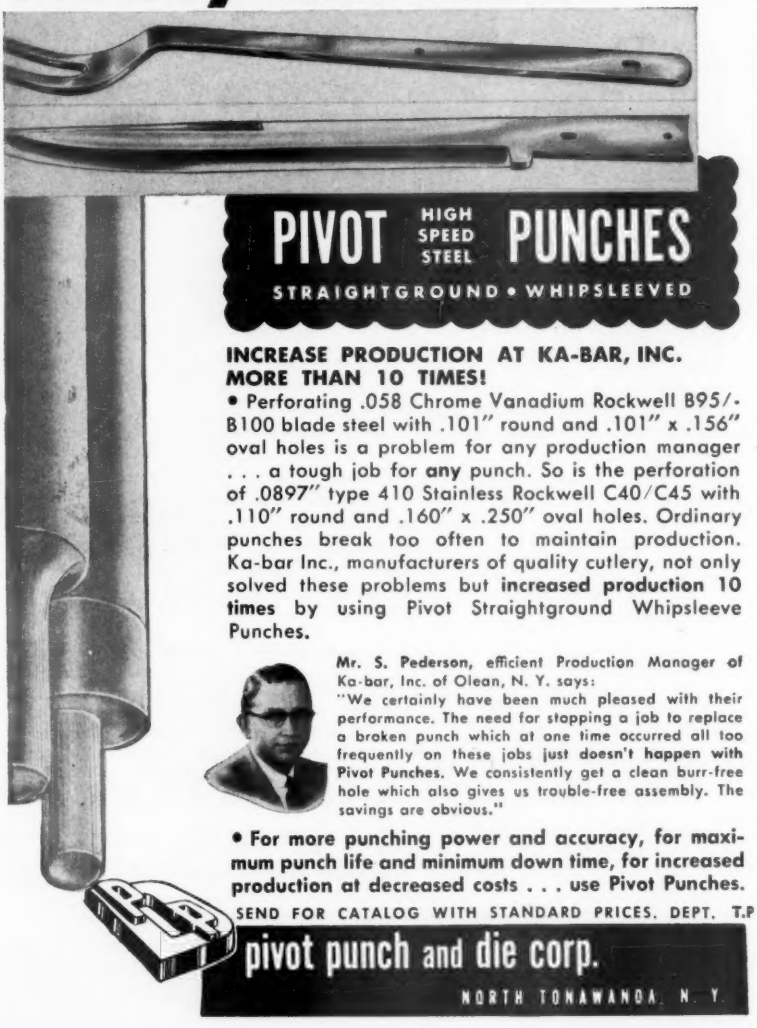
Ideal For Stripping Action in all types of dies, the Wales Hydra-Spring has force up to 3800 pounds. Full data on the various unit models is given in new catalog from Wales-Strippit Corp., 345 Payne Ave., N. Tonowanda, New York.
Circle Inform-A-Gram No. B19.

Accuracy and Concentricity with plus features of long life and a wide selection from standard are boasted by drill jig bushings from Accurate Bushing Company, 447 North Ave., Garwood, N.J.
Circle Inform-A-Gram No. B20.

Collet Chuck Catalog from Sutton Tool Co., Sturgis, Michigan has complete data on company products line. Features include pressure adjusting ring with ball detent lock, positive cam closing collar, hardened cam levers and parallel grip design.
Circle Inform-A-Gram No. B21.

Milling, Drilling and Boring at Any Angle is possible with the 10-R universal milling machine by Fray Machine Tool Co., 515 W. Windsor Rd., Glendale 4, Calif. Set-ups may be changed with speed and ease.
Circle Inform-A-Gram No. B22.

cutlery cuts costs!



INCREASE PRODUCTION AT KA-BAR, INC. MORE THAN 10 TIMES!

• Perforating .058 Chrome Vanadium Rockwell B95/-B100 blade steel with .101" round and .101" x .156" oval holes is a problem for any production manager . . . a tough job for any punch. So is the perforation of .0897" type 410 Stainless Rockwell C40/C45 with .110" round and .160" x .250" oval holes. Ordinary punches break too often to maintain production. Ka-bar Inc., manufacturers of quality cutlery, not only solved these problems but **increased production 10 times** by using Pivot Straightground Whipsleeve Punches.

Mr. S. Pederson, efficient Production Manager of Ka-bar, Inc. of Olean, N. Y. says:
"We certainly have been much pleased with their performance. The need for stopping a job to replace a broken punch which at one time occurred all too frequently on these jobs just doesn't happen with Pivot Punches. We consistently get a clean burr-free hole which also gives us trouble-free assembly. The savings are obvious."

• For more punching power and accuracy, for maximum punch life and minimum down time, for increased production at decreased costs . . . use Pivot Punches.

SEND FOR CATALOG WITH STANDARD PRICES. DEPT. T.P

pivot punch and die corp.
NORTH TONAWANDA, N. Y.

Simplified Piercing, Cut Die Costs and Increased Production are possible with adjustable magnetic piercing dies by S. B. Whistler & Sons, Inc., 748 Military Rd., Buffalo 23, N.Y. Punches and dies are interchangeable, and arrangements may be quickly changed and set-up actually on the press.
Circle Inform-A-Gram No. B23.

Steinel Horizontal and Vertical Milling Machines are featured in a new folder just printed by Morey Machinery Co., Inc., 410 Broome St., New York 13, N.Y. These machines are made in Germany to American specifications and measurements. Ordering information and specifications included.
Circle Inform-A-Gram No. B24.

Simple and Speedy Adjustment of feed length, feed in any of four directions in a wide variety of standard sizes and models are possible with the roll feed by Wittek Mfg. Co., 4323 W. 24th Place, Chicago 23, Ill. Literature on the line is now available.
Circle Inform-A-Gram No. B25.

Direct Acting Hydraulic Press by Verson Allsteel Press Co., 9335 S. Kenwood Ave., Chicago 19, Ill., gives superior forming detail and high capacity using minimum floor and head space. It utilizes an improvement of the rubber pad forming method. Full data in bulletin VW-52.
Circle Inform-A-Gram No. B26.

"Marking Tools," a comprehensive new 32 page catalog describing marking stamps and dies for every industrial application has just been issued by the Parker Stamp Works, Inc., 650 Franklin Ave., Hartford, Conn. Scores of hand and press dies and stamps are illustrated and graphically described.
Circle Inform-A-Gram No. B27.

Quality Control and Magnification are tied together in latest handbook and catalog from Bausch & Lomb Optical Co., 797 Paul St., Rochester 2, N.Y. Explains how to select, operate and apply magnifying equipment in industry.
Circle Inform-A-Gram No. B28.

The Select-O-Matic Indexer by Durant Tool Supply Co., 155 Orange St., Providence 3, R. I., is described in new bulletin now available. This unit permits the engagement of a total of 6,720 possible stations, and is accurate with .0006". For replacement of the conventional clutch on any roll feed.
Circle Inform-A-Gram No. B29.

Four Different Purpose Blade Tooth Sets are offered for your selection in the band saw line of Atlantic Saw Mfg. Co., Brewery St., New Haven, Conn. Literature now available tells how to select the right blade type for your operation for maximum economy and performance.
Circle Inform-A-Gram No. B30.

Designed for Fine Grinding, Burring, and Polishing Operations, the new Benchmaster belt sander is described in literature now available from the Benchmaster Mfg. Co., Gardena, California. Pivoted backup unit retains parallelism with the belt at any table setting.
Circle Inform-A-Gram No. B31.

Rack and Pinion Drive Combines Smoothness and gradual acceleration and deceleration in the automatic roll feed by F. J. Littell Machine Co., 4197 N. Ravenswood Ave., Chicago 13, Ill. Standards for any requirements may multiply your press room output by five.
Circle Inform-A-Gram No. B32.

If You've Got a Grinder, you should also have a copy of the booklet "A New Concept in Grinding Wheels" recently released by Cincinnati Milling Machine Co., Cincinnati 9, Ohio. Contains much valuable information gleaned in the company research laboratories.
Circle Inform-A-Gram No. B33.

Insert Tool Holder in 3 Standard Types and 40 Standard Sizes are described in latest bulletin 521 by the Wesson Co., Ferndale, Michigan. Heavy feeds and high speeds are possible, whilst shank grinding and tip grinding operations are not necessary.
Circle Inform-A-Gram No. B34.

Friction Sawing Offers Big Savings in time and money in some applications. Cuts are fast and smooth, and often no jigs or rests are required. Soft steel or armor plate are machined equally readily. Process and application data in brochure from Tannewitz Works, Grand Rapids, Michigan.
Circle Inform-A-Gram No. B35.

Extremely Large Selection of Standard Drill Jig Bushings is offered in the latest catalog by American Drill Bushing Co., 5107 Pacific Blvd., Los Angeles 58, Calif. Presented in a clear way and well organized, the catalog also has reference charts for pricing and technical data.
Circle Inform-A-Gram No. B36.

Improvements make the Green Engraver More Versatile, retaining a high degree of accuracy and precision. Five reduction ratios are now possible. Full data is now available from the Green Instrument Co., Cambridge, Mass.
Circle Inform-A-Gram No. B37.

Nibblers, Drill Press Vises, and screwless fixture locks are included in the new '53 catalog by Heinrich Tools, Inc., Racine, Wisconsin. Also punches, rod cutters and shears. Well put together for easy reference.
Circle Inform-A-Gram No. B38.

Literature, on Vernier Calipers, Height Gages and Precision Squares is now to be had from Foster Supplies Co., 5252 Broadway, Chicago, Illinois. This is a line of precision equipment incorporating many first-rate features.
Circle Inform-A-Gram No. B39.

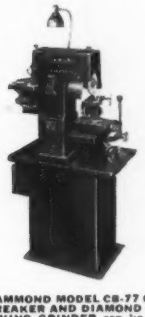
Portable Low Cost High Frequency Industion Heating Unit by Lepel High Frequency Laboratories, Inc., 55th St. & 37th Ave., Woodside 77, N. Y. C. may be used without mountings. Complete data is now available from the manufacturer.
Circle Inform-A-Gram No. B40.

Hammond OF KALAMAZOO
GOOD MACHINERY SINCE '82

FAST ACCURATE GRINDING
of SOLID CARBIDE INSERT TOOLS

FOR ROUNDS, SQUARES,
TRIANGULARS and RECTANGULARS

MODEL VC, Style M Motorized Solid Carbide Insert Grinding Fixture. Style H, without motor also available. Write for Bulletin No. 235.



HAMMOND MODEL CB-77 CHIP BREAKER AND DIAMOND FINISHING GRINDER can be supplied with both the standard Any Angle Vise and the Model VC Solid Carbide Insert Grinding Fixture.

THE Hammond Solid Carbide Insert Grinding Fixture pays for itself in a few weeks. Offers a fast, economical and accurate means of grinding chip breaker grooves in round, square, triangular and rectangular shapes and for rough and finish grinding of dull and damaged carbide inserts. Motorized Style M with lug base can be mounted on most tool and surface grinders and Hammond CB-76, CB-77 and CB-77W Chip Breaker Grinders.

BUILDERS OF AMERICA'S MOST COMPLETE LINE OF CARBIDE TOOL GRINDERS

Hammond Machinery Builders INC
1631 DOUGLAS AVENUE • KALAMAZOO 54, MICHIGAN

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR INFORM-A-GRAM KEY NUMBERS

.0001" Accuracy, Low Cost and Long Life are features of the model SG surface grinder by Sanford Mfg. Corp., 1024 Commerce Ave., Union, N.J. Equipped for wet or dry grinding, ideal both for production work and dies, instrument parts, etc.
Circle Inform-A-Gram No. B41.

Bench Model Universal Box and Pan Bending Brake is described in new mailing piece from Dreis & Krump Mfg. Co., 7400 S. Loomis Blvd., Chicago 36, Ill. Full specifications given on this hand operated, speedy and accurate device.
Circle Inform-A-Gram No. B42.

Set-Up and Hold-Down Tools of many different types in a range to cover almost any work-holding operation are discussed in current brochure from Armstrong Bros. Tool Co., 5220 W. Armstrong Ave., Chicago 30, Ill.
Circle Inform-A-Gram No. B43.

New Dial Bore Gages are covered in catalog DBM from Nilsson Gage Co., Inc., Poughkeepsie, New York. Offers the possibility of perfect visual control right at the machine. Size range covers .090" bore to 48" bore dimensions.
Circle Inform-A-Gram No. B44.

Swedish Craftsmanship!

Sajo Vertical Milling Attachment

The Sajo "Plain" Milling Machine

the SAJO "UNIVERSAL" MILLING MACHINE

exemplifies the expert workmanship that is traditional in Swedish machine tools. Like all SAJO Millers, this new Universal Milling Machine was designed and built to the highest standards of quality and practical utility.

Avoidance of exterior "luxury" features, slight in value but substantial in cost, and concentration on the vital factors of construction, enable the SAJO to deliver top performance at moderate cost.

SAJO Millers are available in Plain and Universal types, with longitudinal power table feed only, or with power feed in all directions. Screws and dials are in the U. S. inch system.

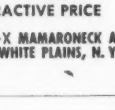
★ Standard Equipment includes:
3 HP motor and starter equipment, motor driven coolant system, adjustable table feed nut to allow climb-milling, 1" arbor, arbor support brace.

★ Extra Equipment:
Universal Dividing Head, Vertical Milling Attachment, Slotting Attachment, Swivel Base Vise, Rotary Table.

CONDENSED SPECIFICATIONS

Table Size	41⅛" x 9¼"
Longitudinal travel: Plain Miller	24½"
Universal Miller	27½"
Transverse travel	8¼"
Vertical travel	19"
12 spindle speeds	36-1540 RPM
Table feeds	12
Taper in spindle	No. 40 NMT
Main motor	3 HP

Precision anti-friction bearings on spindle and gear shafts
One-piece column and base
Net weight—2200 lbs.



Write for Catalog

NO PRIORITY—— PROMPT DELIVERY——ATTRACTIVE PRICE

AUSTIN INDUSTRIAL CORP. 76-X MAMARONECK AVE. WHITE PLAINS, N. Y.
DEALERS IN PRINCIPAL CITIES

Needle Bearing Pilot Bushing has Absolute Seal. A new bushing featured in catalog just released by J. G. Jergens Co., 11106 Avon Ave., Cleveland 5, Ohio provides an absolute seal against dirt, coolants, and grit entering the bearing cavity. Can be disassembled without removing the housing and protect against both thrust and radial loads. Full data from maker.
Circle Inform-A-Gram No. B45.

New 64 Page Fixture Clamp and Component Catalog has just been issued by West Point Mfg. Co., 26935 W. 7 Mile Road, Detroit 19, Michigan. Included are 15 styles of clamps—full scale template sheets—in 100 sizes and over 350 fixture components.
Circle Inform-A-Gram No. B46.

Barnes Hack Saw Blades are made in a wide variety of standard types for almost any metal sawing operation, both in power and hand types. Detailed information is available from W. O. Barnes Co., Inc., 1297 Terminal Ave., Detroit 14, Michigan.
Circle Inform-A-Gram No. B47.

Newcomer Carbide Tipped Tools are described in a bulletin now available from Newcomer Products, Inc., Pittsburgh 21, Pa. They are made in complete line with a style for any purpose to the most rigid quality standards from raw material to finished product.
Circle Inform-A-Gram No. B48.

1953 General Products Catalog from Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Michigan is designed for quick reference in checking basic machine specifications. Gives complete picture of the company products, tells just how to get further information on any item.
Circle Inform-A-Gram No. B49.

Full Operational Data on Valvair Solenoid Pilot Valve for handling air, vacuum, oil, water and inert gases is given in new bulletin "PB" from the Valvair Corp., Akron 11, Ohio. Also features, specifications, drawings and ordering information.
Circle Inform-A-Gram No. B50.

Oil Hardening Non-Warping Tool Steel and drill rods in the Warplis line of the Pittsburgh Tool Steel Wire Co., Monaca, Pa., are featured in latest literature from the company. Over 200 standard stock sizes in this "Tiffany Quality" product line.
Circle Inform-A-Gram No. B51.

Miller Air Cylinders have space saving square design, and are made in complete lines of low, medium and high pressure types. Features include hard chrome plated piston rods, dirt wiper seals, solid steel heads, caps and mountings and brass barrels for the elimination of rust and corrosion. Recently issued bulletins from Miller Motor Co., 2046 N. Hawthorne Ave., Melrose Park, Ill.
Circle Inform-A-Gram No. B52.

South Bend's Popular Light Ten Lathe is featured in new catalog 5216 from South Bend Lathe, South Bend 22, Indiana. Outstanding features are well illustrated, with complete specifications given for the various models covering capacity, feeds, and speeds as well as dimensions and shipping weights.
Circle Inform-A-Gram No. B53.

Barker Bench Milling Machine is ideal for handling small run precision jobs, is described in a new circular from Barker Eng'g Co., 500 Green Rd., Cleveland 21, Ohio. Has great flexibility and quick setup, plus 3-way hand-lever travel and ample rigidity for carbide tooling.
Circle Inform-A-Gram No. B54.

Special Feature Protects Spindle Bearings Permanently under continuous heavy cuts on the engine lathe described in bulletin 603 from the Boye & Emmes Machine Tool Co., 133 Caldwell Dr., Cincinnati 16, O. Assures maximum life and accuracy under the most arduous working conditions.
Circle Inform-A-Gram No. B55.

Notching Units for Mild Steel to ¼" Thick are featured in catalog "N" just off the presses for Wales-Strippit Corp., 345 Payne Ave., North Tonawanda, New York. They are designed to permit the same group to be used in unlimited setups in stamping presses and press brakes. Each unit is independently mounted to permit quick setups according to varying patterns.
Circle Inform-A-Gram No. B56.

Milling and Centering Combination Machines by Motch & Merryweather Machinery Co., Penton Bldg., Cleveland 13, Ohio, are discussed in new bulletin which has just come off the presses. The bulletin illustrates once again the well-known success this company has had in obtaining maximum production per square foot of floor space per operator.
Circle Inform-A-Gram No. B57.

Carbide Inserted Bushings by W. F. Meyers Co., Inc., have tungsten carbide inserts at wear points. Cost approximates with that of steel: wear resistance to that of solid carbide. Bulletin 17, W. F. Meyers Co. Inc., Bedford, Ind.
Circle Inform-A-Gram N.. B58.

"Supeream" Reamers in 470 Standard Sizes are stocked by the Twentieth Century Mfg. Co., 3720 Montrose Ave., Chicago 18, Ill. From .032 in steps of .001. Flutes polished and ground and held to .0002" tolerance.
Circle Inform-A-Gram No. B59.

Diemaking Service on Difficult Applications is offered by Ward Machinery Co., 564 West Washington, Chicago 6, Illinois. Free illustrated catalog has details of the service, also lists many different kinds of punches and dies now in stock.
Circle Inform-A-Gram No. B60.

Reading By Sight, Sound, and Feel. Sturtevant torque wrenches are made in a complete line of capacities from 0 to 6000 ft. lbs. Permanently accurate. P. A. Sturtevant Co., Addison, Ill. has manual with all data.
Circle Inform-A-Gram No. B61.

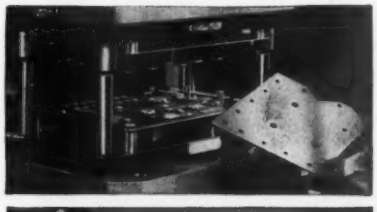
New • Fast • Proven

LOW COST methods for PERFORATING and NOTCHING SHEET METALS

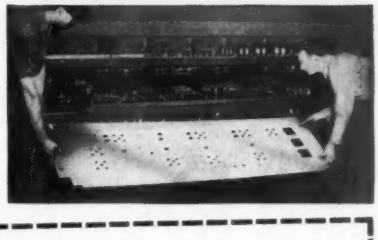
REDUCE DIE COSTS

All units and parts are interchangeable and used repeatedly in different arrangements. **INCREASE PRESS PRODUCTION**—*Down time is minutes as compared to hours for change-over.* For precision work in all types and sizes of presses. **START PRODUCTION AT ONCE.** Pierce materials up to ¼" thick mild steel. Standard sizes and shapes available up to 3 inches. Special sizes to order.

Whistler *MAGNETIC* Dies at work in large inclinable press. Magnetized retainers hold the units. No bolting required. A fast, economical method in making up a punch and die set for short or long runs. All parts re-usable.



Whistler *ADJUSTABLE* Dies on perforating and notching job, using Tee slotted die set. With Whistler Adjustable Punch and Die units production starts within hours instead of weeks. Last minute job changes made quickly.



● Here are the complete details with prices and application illustrations. Send for these catalogs. No obligation.

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Adjustable, Magnetic, Custom and Cam Dies for all Industry

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For your convenience **Whistler direct factory representatives are located in most principal cities. Their on-the-job application experience, combined with Whistler's 35 years experience in the manufacture of tools and dies, is available on request.**

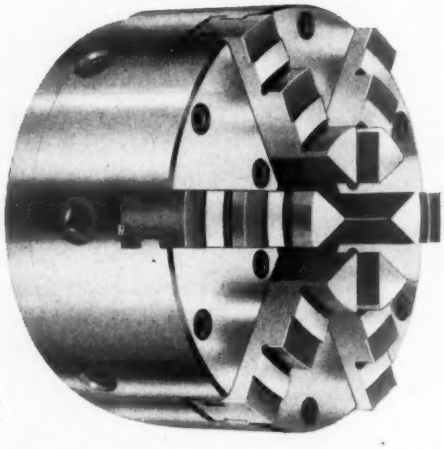
Cast Aluminum Unmachined Controls are described in bulletin TP-10 from Jergens Tool Specialty Co., 712 E. 163rd St., Cleveland 10, Ohio. Straight or angled hand wheels, offset handle speed handles and clamping levers, etc.
Circle Inform-A-Gram No. B62.

Koch Test Indicator for precision work is the subject of a recent mailing piece from Andrew Genales, 28 Second Ave., Nyack, New York. Gives all features, specifications attachments, etc.
Circle Inform-A-Gram No. B63.

Exhaustive Listing of Standard and Special Tools of all types is contained in latest 120 page catalog from Gorham Tool Co., 14415 Woodrow Wilson, Detroit 3, Mich. Much useful cutting tool information and engineering data section.
Circle Inform-A-Gram No. B64.

One of the Most Exhaustive Selections of Rifflers in almost unlimited shape and size range is described in catalog AF-3 from the Grobet File Co. of America, Inc., 421 Canal St., New York 13, New York.
Circle Inform-A-Gram No. B65.

You Asked For It!



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External and internal, in 4", 5", 6", 7½" — and now 9" — chuck diameters.

Now there's a 9" Buck Ajust-Tru chuck, which many manufacturers asked to be produced.

Its jaws hold work from ¼" to 8" outside diameter.

It adjusts to within .0005" much quicker than any other chuck — *holds* that precision on duplicate parts with *scroll chuck re-chucking speed.*

There's nothing like it — *anyplace* — for saving you money in the tool room, or on production. Send for catalog with complete details.

BUCK TOOL COMPANY
518 Schippers Lane • Kalamazoo, Michigan

40 Graphic Pages of Information on tool post grinders, hand grinders, flexible shaft tools, automatic drill heads, light drilling equipment and drill grinders are contained in the latest catalog from the Dumore Company, Racine, Wisconsin. New price list is coordinated.
Circle Inform-A-Gram No. B66.

Lifting and Moving Awkward Loads is Easy with materials handling equipment by Big Joe Mfg. Co., 904-906 W. Jackson Blvd., Chicago 7, Ill. Both manual and power models available. Weights to 750 or 1000 lbs; lifting heights to 54", 68", or 80". Specifications available.
Circle Inform-A-Gram No. B67.

How To Select Your Cutting Tool Materials is told by latest tooling brochure from Allegheny Ludlum Steel Corp., Henry W. Oliver Bldg., Pittsburgh 22, Pa. Contains 36 pages of compact and unbiased selection data to supplement your basic knowledge.
Circle Inform-A-Gram No. B68.

Motorized Hopper Units, Power Screwdrivers, nut drivers and special assembling machines are all described in literature from Detroit Power Screwdriver Co., 2827 W. Fort St., Detroit 16, Michigan. Screws driven as fast as one a second.
Circle Inform-A-Gram No. B69.

Ground Tool Steel in an extremely large size range is discussed in literature now available from Marshall Steel Co., Box 108-TP, Lagrange, Ill. Water, oil, and air-hardening types. Also a new line of straight edges stocked in a full size range.
Circle Inform-A-Gram No. B70.

Self-Contained Drilling Units by Black Drill Co., Inc., 1368 East 222nd St., Cleveland 17, Ohio, has many progressive design features for smooth and rapid operation. Depth of hole is controlled to within .001"; wide variety of speeds and sizes. Catalog available.
Circle Inform-A-Gram No. B71.

Smooth Oil-Hydraulic Power and Control are feature of the Denison Multipress, together with complete adjustability of ram stroke length, speed, and pressure. By Denison Eng'g Co., 1197 Dublin Rd., Columbus 16, Ohio, who now have a complete series of "Data Logs," or detailed procedures for all conceivable types of pressing operations.
Circle Inform-A-Gram No. B72.

New Machine Leveling Device developed by Enterprise Machine Parts Corp., 2735 Jerome Ave., Detroit 12, Michigan features simple turn of one nut to raise or lower machine. This style JS 'Empco' jack is tested to support twenty tons and lift 8000 lbs. Three sizes.
Circle Inform-A-Gram No. B73.

Collets, Live Centers, and Draw Bars are typical of the line of machine attachments by General Die & Stamping Co., 264 Mott St., New York 12, New York. All products manufactured to exacting quality specifications. Catalog now available.
Circle Inform-A-Gram No. B74.

General Purpose Tungsten Carbide Tools are featured in new catalog from Willey's Carbide Tool Co., 1340 W. Vernor Highway, Detroit, Michigan. Full information on standard tools and blanks, also on gages; centers; broaches; drills; centerless grinder rests and other production tools.
Circle Inform-A-Gram No. B75.

Interchangeable Shanks permit use in turret lathes, jig borers, milling machines, boring mills, etc. of the Maxwell EZ boring tools. Three models cover wide capacity range. All feature quick set-up and accuracy to .0001". Maxwell Co., 250 Broadway, Bedford, O.
Circle Inform-A-Gram No. B76.

Simplified Jig and Fixture Construction is possible with universal index plungers by Universal Engineering Co., Frankenmuth, Michigan. Plunger body and bushing have same diameter, and holes can be bored with the same tool in one setting. Straight and taper types in large standard size range available.
Circle Inform-A-Gram No. B77.

Saving Time and Materials in such applications as checking hole sizes and locations, finding centers and gaging slots is simple with precision taper pin gages by Horberg Gage Co., 29 Staples St., Bridgeport, Conn. Kits and complete size ranges. Literature available.
Circle Inform-A-Gram No. B78.

Specially Built for Heavy Duty Work, the Clausing 18" heavy-duty drill press combines massive general construction for great rigidity with many exclusive features that improve accuracy and save time. Capacity to 1" in cast iron, 3/4" in steel. Catalog — Clausing Div., Atlas Press Co., 2-115 N. Pitcher St., Kalamazoo, Michigan.
Circle Inform-A-Gram No. B79.

Standard Parts for Jigs and Fixtures are detailed in a new comprehensive catalog from the Tietzmann Tool Corp., 315-317 N. Main St., Dept. A., Englewood, Colorado. Sizes for every job are carried in stock.
Circle Inform-A-Gram No. B80.

In Both Vanadium and High Chrome High Carbon Steels, punches by Ring Punch & Die Corp., 108 Foote Ave., Jamestown, N.Y. are described in current literature. Also complete line of button dies in ring and press fit types.
Circle Inform-A-Gram No. B81.

New Cincinnati Press Brake Catalog has 62 pages of comprehensive data on press brake applications, selection, tooling, and on the complete line of Cincinnati Shaper Co., Cincinnati 25, Ohio. It's just become available, don't miss your copy. Catalog B-4. O.
Circle Inform-A-Gram No. B82.

Pictorial Style Catalog on the Jungner tool and cutter grinder is now available from Nife, Inc., Copiague, Long Island, New York. Set-ups, attachments, versatility are graphically demonstrated.
Circle Inform-A-Gram No. B83.

FLEXIBLE SHAFT TOOLS

SEND FOR BULLETINS!

Complete bulletins and operating data are quickly available. Send today, stating your particular production problem. Use the Coupon.

Whether you're finishing a casting, a weld, a fine die or stainless steel surface, you'll get the equipment that will do the job best from the best-known name in flexible shaft equipment—Haskins. Here is a company with a world of finishing experience to offer you—and a line of flexible shaft equipment in which long-life, multiple usefulness and economy have never been sacrificed to price.

R. G. HASKINS COMPANY 2647 W. Harrison St., Chicago, Ill.

Send data on Haskins equipment for_____ (state operation)

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Catalog Giving Complete Coverage to precision files for your shop needs is now available from Nicholson File Co., 95 Acorn St., Providence 1, R. I. Has all file types in an exhaustive line finely quality controlled.
Circle Inform-A-Gram No. B84.

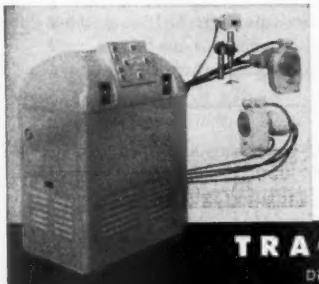
16" 12 Speed Lathe is featured in new bulletin 5302CD from South Bend Lathe, South Bend 22, Indiana. This machine is engineered for high production and extreme precision at low initial and maintenance cost. Full specifications, data, etc.
Circle Inform-A-Gram No. B85.

Chemical and Physical Properties of bronze welding alloys produced by Titan Metal Manufacturing Co., Bellefonte, Pa., are outlined in a new six page folder just off the press. Gives interesting detail on the company's rigid laboratory control methods.
Circle Inform-A-Gram No. B86.

Profuse Illustrations, Operating Hints and Technical Data characterize current three color catalog on washers from Detrex Corp., Box 501, Detroit 32, Michigan.
Circle Inform-A-Gram No. B87.

DUPLICATE MACHINED PROFILES and CONTOURS ON A PRODUCTION BASIS

PERFORM INTERNAL AND EXTERNAL CONTOUR WORK ON LATHE OR MILL... *at low cost!*



Original accuracy, normal cutting speeds, simple operation. (1) Controls two feeds simultaneously. (2) Does not interfere with conventional use of machine. (3) Applicable to most standard machine tools . . . This may be the answer for which you have searched . . . Write for our catalog.

90° shoulder and contour on lathe work

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Distributors for Lodge & Shipley Duplicator
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Universal Carbide Grinder features new reciprocating action and has a chip breaker attachment and table for small radius grinding as standard equipment. Full specifications and data are given in a catalog offered by E. F. Hager & Son, Queens Village 9, New York.
Circle Inform-A-Gram No. B88.

Precision is the Keynote of the line of lathes by the Sheldon Machine Co., Inc., 4235 N. Knox Ave., Chicago 41, Ill. Catalog now ready for distribution tells story of the rigid manufacturing standards that make this line a "buy" for anyone's dollar.
Circle Inform-A-Gram No. B89.

Power Feed Surface Grinder #3B by Abrasive Machine Tool Co., 16 Dunellen Rd., East Providence 14, R.I. is discussed in latest illustrated catalog. Features include automatic and adjustable feeds, unit construction, wet or dry grinding, and wide range capacity.
Circle Inform-A-Gram No. B90.

Brown & Sharpe Milling Cutters are discussed in the latest company catalog. Styles include every type from plain milling cutters and end mills to metal slitting saws and cutters for special uses. Your copy — Brown & Sharpe Mfg. Co., Providence 1, R. I.
Circle Inform-A-Gram No. B91.

Many Different Stereoscopic Microscopes are featured in current literature from The American Optical Co., Instrument Div., Buffalo 15, New York. These instruments give three dimensional view of the object, are becoming increasingly popular in examining and assembling small precision parts.
Circle Inform-A-Gram No. B92.

Four Well-Illustrated Sections describe the Power-Grip magnetic chuck in a new circular issued by Sundstrand Machine Tool Co., Rockford, Illinois. Contains helpful setup suggestions. This chuck is well suited to heavy duty milling, production milling, production grinding and general grinding operations.
Circle Inform-A-Gram No. B93.

Information on Operation and Applications of on-off, two position, three position, and pulse type time-proportioning controllers is included in new catalog 1053 from Minneapolis-Honeywell Regulator Co., Brown Instruments Div., Wayne & Windrim Avenues, Philadelphia 44, Pa. Also data on primary measuring elements, ordering information and scale selection tables.
Circle Inform-A-Gram No. B94.

Constituting a Complete Reference Book on motors and generators, new brochure 51R7933 has just been made available by the Allis-Chalmers Mfg. Co., 1013 So. 70th St., Milwaukee, Wisconsin. Text and illustrations on integral horsepower motors and generators for the manual were furnished by the company in cooperation with the Electrical Modernization Bureau.
Circle Inform-A-Gram No. B95.

Data Sheets, Catalogs and Ordering Information on "Dip-Pak" plastic parts coating for protective and transit purposes are now available in complete package from Fidelity Chemical Products Corp., 470-474 Frelinhuysen Ave., Newark, New Jersey. Full information on different grades and applications.
Circle Inform-A-Gram No. B96.

Fourteen Typical Materials Handling Applications of Cone-Drive double enveloping worm gear sets and speed reducers are described and illustrated in a new 8 page brochure from Cone-Drive Gears Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Michigan.
Circle Inform-A-Gram No. B97.

"Heavy Duty Cleaning The Fast Way" is title of a new booklet from the Cowles Chemical Company, 7016 Euclid Ave., Cleveland 3, Ohio. Interesting descriptions are given on a number of the company products and applications in specific metal cleaning operations.
Circle Inform-A-Gram No. B98.

Better Maintenance, Safety, and Production is the keynote of the new '53 catalog from Martindale Electric Co., Box 617, Edgewater Branch, Cleveland 7, Ohio. Rotary tools, flexible shaft equipment, safety devices, metal working and maintenance tools are featured.
Circle Inform-A-Gram No. B99.

60 Years' Machinery Progress are represented in new combination machine bulletin from Kling Bros. Eng'g Works, 4434 Kamerling Ave., Chicago, Ill. Detailed information and specifications given on capacities and features of the combination shear, punch, and coper.
Circle Inform-A-Gram No. B100.

Portable Hardness Testers in a complete line are featured in 20 page fully illustrated catalog just published by Ames Precision Machine Works, Waltham, Mass. Includes a treatise on Rockwell hardness testing, hardness scale charts, etc.
Circle Inform-A-Gram No. B101.

Dillon #L Universal Tester is made in seven different ranges and will test materials with a tensile strength varying from only a few pounds to 160,000 PSI. Bulletin #2 from W. C. Dillon & Co., Inc., 14620 Keswick St., Van Nuys, Calif., has all data, including price sheets, attachments and specifications.
Circle Inform-A-Gram No. B102.

Homestrand Vernier Height Gages, with application data, are discussed in the current catalog from Homestrand, Inc., Larchmont, N. Y.
Circle Inform-A-Gram No. B103.

One Press Works Like Two. New bulletin 219 from Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill., has all data and operational photos on this recently developed machine.
Circle Inform-A-Gram No. B104.

"Mondial" Engine and Production Lathes are the subject of a new folder just issued by Morey Machinery Co., 410 Broome Street., New York 13, New York. Complete data is furnished on the complete line of these attractive machines.
Circle Inform-A-Gram No. B105.

JOHNSON BAND SAWS

BOTH WET AND DRY MODELS

SPECIFICATIONS—MODEL J

Capacity—10″ rounds, 18″ flats
Motor—½ H.P. Ball Bearing any voltage available, single or polyphase (¾ H.P. on wet machine).
Wheel Diameters—16″.
Floor Space—66″ x 31″.
Bed—11″ wide, 44″ long, 6″ deep, 24″ high.
Overall Height (Closed)—39″.
Blade Length—11′5″ x ¾″ x 032″ All Standard blades of these specifications can be used.
Weight—Approximately 750 lbs. Crated 800 lbs. Boxed for export 875 lbs.
Speeds—35, 90, 130, 190 feet per minute.
Casters—Optional at slight extra cost.

MODEL B, 5″ x 10″ CAPACITY ALSO AVAILABLE

WRITE FOR DETAILS

JOHNSON MANUFACTURING CORP.
ALBION, MICHIGAN

. . . Hard Facing, from page 51

surface roughness are probably the principal factors that decide whether hard facing should be used in comparison with sintered carbides. The original welded surface can be either rough because of projecting granules or smooth because of considerable base metal fusion.

Protection of the cutting edges and gauge surfaces of rotary drill bits probably represents the largest single application of tungsten carbide hard facing. Here, dimensional control is essential. Both oxyacetylene and atomic hydrogen flames are employed. Composite rods are used with the former, but the latter may feature another method that merits description. The areas to be protected by hard facing are painted with sodium silicate solution (water glass) and while sticky are sprinkled with bulk carbide granules. After drying, the base metal is carefully heated with the atomic hydrogen flame, which provides effective protection against oxidation. When the surface melts, it wets the silicate anchored granules and after solidification holds them firmly in place.

Tungsten carbide is but one of the various hard compounds that can be exploited for wear resistance by the hard facing technique. Chromium carbide (Cr_7C_3), for example, is about as hard as the secondary tungsten-iron carbide (Fig. 5), but is less expensive. It can be used in the form of a multitude of microscopic crystals in either soft or hard matrices.[4] These weld deposits tend to polish and wear smooth, contrasting with the rough differential wear of the ones described here.

Surface protection by hard facing has the advantage of placing protection economically at the exact focal areas where wear appears; of permitting the use of very hard compounds; of easy application in the field and in maintenance shops as well as in manufacturing plants; of protection in depth when compared with carburizing, nitriding and the like; of economy in the use of expensive alloy elements; and of permitting a hard wear resistant surface to be reinforced by a tough, ductile base. When effectively employed by competent mechanics and engineers, it usually provides economies.

Next Month — 7th Annual PRESS DIES & STAMPINGS Feature Issue

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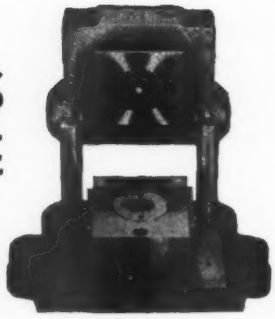
1. Haworth, R. D., Jr., "The Abrasion Resistance of Metals", Trans. A.S.M., Vol. 41, pp. 819-854 (1949).
2. Avery, Howard S., "Some Characteristics of Composite Tungsten Carbide Weld Deposits", WELDING JOURNAL, Vol. 30, No. 2, Feb. 1951, pp. 144-160.
3. Avery, Howard S., "Hot Hardness of Hard Facing Alloys", WELDING JOURNAL, Vol. 29, No. 7, July 1950, pp. 552-578.
4. Avery, Howard S. and Chapin, Henry J., "Hard Facing Alloys of the Chromium Carbide Type", WELDING JOURNAL, Vol. 31, No. 10, Oct. 1952, pp. 917-930.

"A MUST wherever WASHERS are made!"

HOVIS OFFERS YOU THIS SIMPLE, UP-TO-THE MINUTE METHOD

There's no need to make a complete new Die for any type washer or blank. The HOVIS UNIVERSAL WASHER DIES provide a Master Holder and by merely changing 5 SMALL, EASILY REMOVABLE PARTS the new washer or blank is produced . . . Special sets of parts are available for use in Master Washer Units enabling customers to produce irregularly shaped pieces and shallow draws. Multi-Washer Dies are also designed and manufactured.



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HOVIS SCREWLOCK COMPANY

8100 E. NINE MILE ROAD
Phone: Slocum 7-4800

VAN DYKE, MICHIGAN
Suburb of Detroit

. . . Battery Repair, from page 68

The carbon burner consists only for an electrode holder and a carbon rod. It is designed for six volts (three cells of a battery) as its power supply. It is a common error to use the carbon burner on either fewer or more cells, the former being inadequate for making a good weld, the latter endangering battery, operator and joint.

The burning tool may be connected either directly to the battery being worked upon or to three cells of an adjacent battery (if the unit under repair is entirely discharged).

The rod is pointed to a ⅛" tip and is permitted to extend from the holder to a length of about 1½". When possible, it should be connected to its power source so that the carbon rod is of negative polarity. This makes welding easier as it tends to keep the joint and the working surface clean. The lead surfaces to be welded must be clean. A wire brush may be used for this purpose after the surfaces have been neutralized. The inside hole of a connector may be cleaned with a knife. The tip of the carbon should be wire-brushed before starting. Dark glasses are recommended.

The secret of making a good joint is to have clean materials and a hot carbon. The technique calls for thoroughly heating the center of the part being worked until a puddle of molten metal exists. Only then may additional lead be added. Work rapidly to complete the operation before the entire part melts. When possible use a damp rag to surround the part being worked on. When building up posts or splicing a connector, use molds made for the purpose.

After making a burn, allow the joint to cool undisturbed. In cooling the lead will shrink slightly. Do not move or disturb the joint during cooling; this may cause the lead to crystallize, resulting in poor joint.

When working within a mold, it is necessary that the carbon not be permitted to touch the side of the mold.

To determine whether a weld has been properly made it is wise to test with a pair of pliers (after the joint has cooled) to see if the joint will strongly resist separation. If separation occurs, examine the two surfaces to determine the points and nature of weakness so that the situation can be corrected on the second try.

When adding new lead to a joint, touch the new lead to the carbon rod and let it flow down into the puddle rather than to plung cold lead into the puddle itself.

In burning a connector to a post, one slow trip around the post should be sufficient to make a satisfactory weld. Although the same is true of burning a post to the lead-insert of a new cover, the depth of the joint is such that considerable lead will have been removed from the post in the single slow circuit around the joint. Therefore, the carbon point should be returned to the center of the post and new lead added to raise the post height up to the level of the top of the post mold.

MÄGERLE HYDRAULIC SURFACE GRINDERS

AUTOMATIC DOWN FEED
•
AUTOMATIC FINISH SIZING

A work measuring instrument reveals the difference between work size and required final size during the grinding operation . . . The automatic feeding and sizing is powered by a separate electrical unit . . . The machine requires no attendance during the grinding operation

Finishes within .0002 on repeated chuck loadings automatically . . . Rapid traverse is provided for both head and cross slide . . . Extremely rugged construction and very easy to operate . . . Available in 2 foot, 3 foot and 4 foot models . . .

Write for Our Eight-Page, Illustrated Circular.

PELLOW MACHINE CO.
13500 FOLEY AVENUE • DETROIT 27, MICHIGAN

. . . Automatic Factory, from page 33

been designed with automation in mind. This is planned so that automation will be considered in all programs.

Automation devices are designed to move parts into and out of production machines, turn the part over, rotate it, remove scrap, and perform other related functions. Scrap removal on a continuous and automatic basis is a necessity in both machining and stamping operations. These devices are timed with the process and are ordinarily completely automatic while in operation. A finished piece of automation equipment is made up largely of standard elements such as conveyors, air, hydraulic, and electrical control mechanisms arranged properly.

In many respects, automation is the extended usage of conveyors which played such an important part in the early development of mass production of automobiles.

We have been able to place proper emphasis on design to obtain simplicity and to eliminate maintenance problems after installation, as well as to obtain completely automatic operations. The individual and specialized treatment possible with this type of system has produced results which could not have been attained on any other basis.

Advantages of Automation

The advantages which we have obtained, in a general way are as follows:

Lower Production Costs. Automation assists greatly by relief of manual effort required in handling parts and the resultant inherent delay, especially in large volume operations. This does not mean elimination of all manpower, but rather a redistribution of manpower which will result in the need for more skilled workmen. It eliminates monotonous, repetitive work in many cases while at the same time increases production. We have found it possible to make worthwhile Direct Labor savings.

Increased Machine Speed. Very often the speed at which a machine produces a part is determined by the loading and unloading operations. Automatic transfer between operations has resulted in greater use factors for machines. The machinery has been able to operate closer to its designed capacity. This is, of course, a definite advantage. In some press lines, it was impossible to load the presses fast enough by hand to keep them running continuously. Automation made it possible to do so on many machines. The connection of all elements of a production process for complete synchronization is a reality and has been accomplished on many of our machine lines.

Quality. Less scrap and fewer rejects often result from the use of automation, which reduces damage caused by parts hitting each other or falling to the floor.

Safety. The handling of cumbersome parts manually can, at times, become quite hazardous even with the best safety devices. Use of automation to handle stampings into and out of presses and at turn-over operations are good examples of this type.

Disadvantages of Automation

In discussing automation with others in manufacturing from other industries, we very often find disadvantages which appear as stumbling blocks to the use of automation. We usually find that these disadvantages have not been fully analyzed in evaluating the program. To help understand the subject thoroughly, I would like to bring out these items briefly as follows:

Maintenance Costs. Use of automation devices in the production processes naturally causes maintenance problems which could offset the savings to be made if not properly handled. Many departments have become nearly 100% automatic; any breakdown of even the smallest element can shut down the entire line. This maintenance prob-

LEMPCO
1/2 Ton
Low Cost TRAVELLING CRANE
Lifts and moves up to 1,000 lbs., operates easily in close quarters, low enough to go into elevators, small enough to operate in aisles and through doors.
Moves and places machine assemblies, tote pans, waste drums; inexpensive substitute for travelling hoist. Features single unit hydraulic pump; no hose or couplings to fail. Lift height over 6 ft., also available in 1 and 2 ton capacities. Write for ½ ton Mobilcrane Bulletin. Lempco Products, Inc., (Industrial Division), Bedford, Ohio
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For 35 years a leading builder of machine tools
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lem has been minimized as skill in automation design has increased. We have simplified details of the systems. Many of the devices are made more substantial, and preventive maintenance has become a **must** in our plants.

Engineering Costs. These costs, of course, are common to all engineering endeavor but are especially important here because of the need for coordination of so many elements such as plant layout, tool design, die design, machine tool builders, material handling engineering, and others.

Much careful planning and hours of work are necessary before construction can start. Three-dimensional models are sometimes developed, and more often perspective drawings are made as part of this plan.

Installation Costs. These costs are normal in considering any piece of production equipment. In studying existing operations, however, an unusual problem arises. It is often necessary to rearrange machinery. This can be an expensive operation. However, we have found many cases where the advantages to be gained made this possible. Proper planning can make the installation of automation devices occur at model change time when rearrangements are often necessary due to changes in processing.

Specialized Nature of Automation Equipment. Every product studied requires special consideration. We manufacture a wide variety of parts of different sizes and shapes, and the machinery and production equipment we utilize varies in size. Our present emphasis on automation makes it possible to study problems at the beginning of new programs so that standardized automation devices can be used to minimize this problem.

Initiating and Automation Program

The above list of advantages and disadvantages, we hope, gives you an overall idea of the scope of the problem. The development of automation equipment is very often not a simple process.

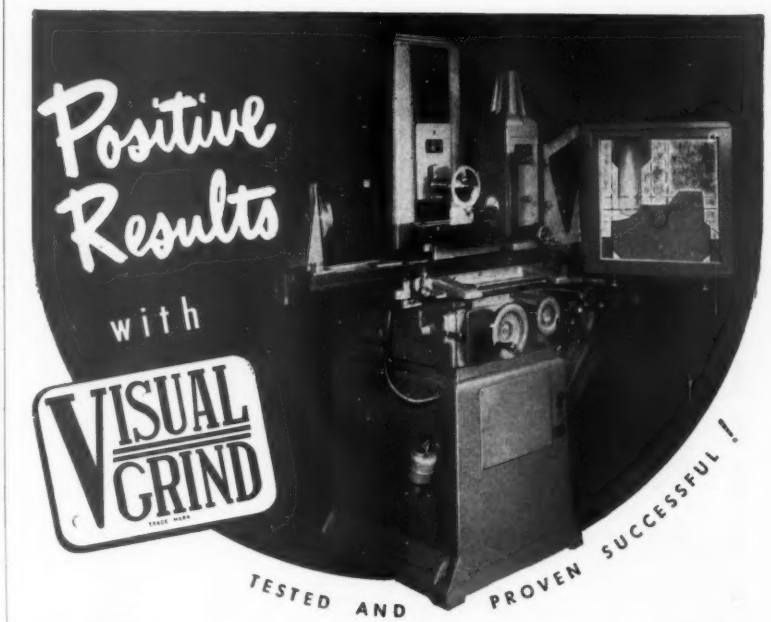
We have people in our Company who are specialists and concentrate on automation design. An automation designer must have imagination, engineering knowledge, and design experience; and, he must think in terms of equipment which very often is a compromise between the comparatively loose standards used for designing a conveyor and the close standards utilized in normal tool and die design. This is the man who starts analyzing a program when the general plant layout has been agreed upon and detailed layouts are in their early stage.

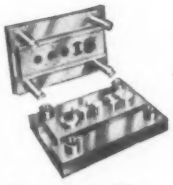
We ordinarily give one automation engineer responsibility for work on a complete part. As the detailed plant layout is developed, the automation man must be readily available so that arrangements can be made for the installation of the simplest possible transfer mechanism. At this point, many interested parties from production and higher management view the overall plan.

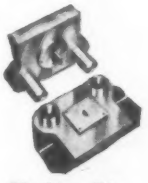
This is the time for quick calculations and simple sketches to help determine in a preliminary way the extent of automation which is justified by the economics and other related factors. We quite often find that the right type of automation equipment costs very little more than standard conveyances which must be supplied as a minimum.

The part to be produced must be carefully studied for adaptability to automation. Preliminary manpower estimates must be considered. We may find that one operator can load and unload several or more machines; or, he may be required for such reasons as assembly, manual control, observation, or others, and automation may not be necessary.

Once we decide on the plant layout to be used, the automation engineer starts his detailed study of the complete program. An overall preliminary automation layout is made. It shows all of the elements




Progressive Die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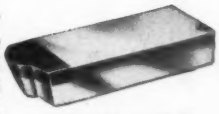
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required. In some cases, models and three-dimensional drawings are made to be certain of some of the details and to make proper presentation to management for approval.

This preliminary automation layout is then analyzed for estimated installed cost. Our Industrial Engineering Department analyzes the manpower requirements for the entire layout, both with and without automation. We then have cost figures which enable us to make a proper decision as to the extent of automation. This data is summarized and presented to management for approval.

When the program is approved, the really important work begins. The plant layouts must be revised wherever necessary so that the automation equipment is allowed adequate space.

The Processing Department revises their operation sheets where necessary to include the effects of the automation equipment.

The Tool & Die Design Department is consulted so that proper coordination takes place. It is important that clearances are left in dies and tools for introduction of automation devices to load and unload work.

The machinery and equipment builders are consulted so that work heights are standardized and they realize the type of program which is being planned.

At this point it is possible to make a final automation layout, and we are ready to proceed with the procurement of the equipment.

In the development of automation at Ford, we have procured equipment in several ways. One way was to do the design work within the Company, write the necessary specifications, and then procure the equipment from outside builders who would install the units. This often resulted in split responsibility for design, construction, and installation. We are working towards a program in which the contractor shall completely design, fabricate, deliver, and install all of the automation equipment including testing before it is accepted by the Company.

Inasmuch as automation equipment is a key item in a production process, we feel that placing all of the responsibility with one party is much better if it can possibly be utilized. The automation engineer must continue to follow the program until the entire system is in operation. It is necessary to keep in close touch with field conditions to take care of minor changes which may be necessary as the various other items of production equipment are installed in their proper places.

Economics Involved

Automation expenditures must be expected to produce results in terms of increased production, lower costs, better working conditions, or other benefits. We in the automobile industry find this problem especially significant since many of our parts become obsolete after one year. It is apparent that systems which do not amortize themselves in less than a model year are generally not economically advisable. We do find, however, that there are many cases in our press lines for body parts, and in our machining lines for engine and chassis parts, where longer amortization periods are permissible. Very often the basic system can be utilized for several years inasmuch as the year-to-year changes would not make the equipment obsolete.

At our Cleveland Engine Plant, a department manufactures cylinder blocks at a rate in excess of 2,000 blocks in 16 hours. The machinery and equipment is all new and of the latest design, with many new transfer type machines. In our original plant layouts, roller conveyor was considered throughout. The production capacity was such that the department was made up of several machine lines. As the operations progressed, they were split up from one machine per operation to two

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15/64	1.95	13/32	3.05	21/32	5.20
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9/16	7.70	11/16	9.20	7/8	13.20
37/64	8.25	45/64	9.40	29/32	14.00
19/32	8.25	23/32	9.40	15/16	14.50
39/64	9.00	47/64	9.60	31/32	15.50
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15" CUTTING FLUTE, 20" OVERALL

Size Inches	Price Each Net	Size Inches	Price Each Net	Size Inches	Price Each Net
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or three machines per operation, etc. For a standard roller conveyor system, this meant many large radius turns and manual handling of parts for proper distribution of parts to the machine lines. Also, there were several places where it was necessary to turn the block over or to rotate it at 90° which resulted in manual operations. Nearly all machine operators had to handle a part in some way.

Our Automation Section studied the plant layout using the method we have outlined, and their analyses indicated the need for automation equipment. The plant layout which developed was more compact and a system of automation was developed which extended automatic features of the machine tools. The labor required for handling of parts approached the vanishing point. The entire department became a synchronized system and functioned as one large transfer machine. It is not necessary for any operator to push, pull, turn-over, or position a part.

The economics of the study indicated that the system would cost more than the standard system previously proposed; but that it would amortize itself in a comparatively short period.

Maximum economy of installation and savings in handling operations can only be obtained when the plant layout is in its early stages. Automation must be considered as a tool to do a given job just as we select drills, mills, broaches, presses, and other types of machinery to produce a part as specified.

Preventive Maintenance

Maintenance of automatic machines and automation equipment is a new challenge to our resourcefulness. As we have pointed out, the breakdown of even one small element will shut down the entire production line.

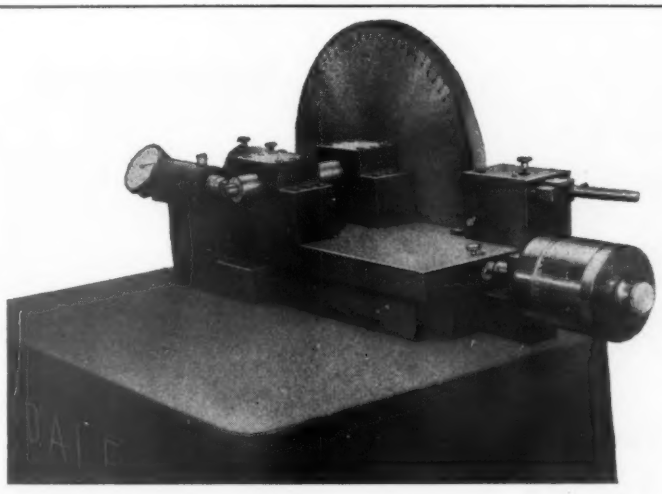
Our answer to this new problem is preventive maintenance which is a must for the modern production line based on continuous low cost production. In the past, maintenance was based on repairing equipment after it had broken down. This approach is not satisfactory today. Our entire production system is geared to a uniform production rate per hour without the possibility of making up lost production due to breakdowns.

Preventive maintenance is the key to continuing production and involves generally the keeping of accurate records of lubrication, expected life of perishable parts, and replacing these parts before they fail and stop production.

To set up a modern preventive maintenance program requires a considerable amount of forethought.

One of the very effective tools which can be used is a Standards Program. In the Ford Motor Company this includes standardization of Tools, Methods and Specifications, Industrial Equipment, Process Standards, and Material Standards. These Standards are based on exhaustive surveys of alternate methods. Benefits are directly applicable to the preventive maintenance program. Standardization simplified the procurement program, and greatly simplified the problem of keeping adequate supplies in stock for necessary repairs.

As an example of what has been accomplished, the Standard Tool Layout has cut tool change down time to a minimum. At our Cleveland Engine Plant, it is seen in action in conjunction with an Automatic Tool Control Board, which is a recent development and already is accepted as an outstanding feature of our maintenance program. By means of this system, a supply of tools for a given transfer machine is kept adjacent to the machine. There is a definite location in the Board for each tool used. Each tool on the Board has been pre-set in accordance with our Standards so that it can replace a worn-out tool without adjustments on a machine. Each tool is represented by a toolometer dial which connects to the machine.



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The pointers on the dial are set at a pre-determined number of pieces depending upon the known life of the tool just prior to need for a re-grind. When any particular tool has reached the pre-determined number of pieces, the machine is automatically shut down.

By scanning the Tool Control Board, the set-up man can readily determine the tools requiring immediate changing. He also selects other tools to change at the same time where the indicator pointer has reached the red "danger" area. Through this preventive maintenance method of changing tools, machine down time is held to the absolute minimum.

Another important factor is the use of Joint Industry Conference Standards which are a collection of sound engineering and installation practices. They provide detailed specifications for the application of Electrical, Hydraulic, Lubrication, and Pneumatic apparatus to machine tools and other industrial equipment.

The development of automatic and semi-automatic machinery during the past decade created an urgent need for standardization in these fields. In the early stages of use of complicated automatic mechanisms, maintenance costs were often excessively high and the trouble arose chiefly from lack of Standards.

The problem involved many users and suppliers and it was, therefore, necessary that it be solved on an industry-wide basis. Joint action was required between the automobile manufacturers, the equipment builders, and the associations in those fields. Recognizing this, Ford representatives and representatives from the various automobile manufacturers, machine tool builders, and other interested producers, and associations, developed what is now known as the J.I.C. Standards.

The Standards developed were based on logical systems of identification, greater accessibility of components; better protection from contamination, and hazards; and have resulted in greater continuity of production and elimination of many hazardous conditions.

Very often in the past, electrical control panels were supplied in which insufficient consideration had been given to safety, identification of apparatus and wiring, accessibility for maintenance, and the exclusion of foreign matter which impaired the operation of electrical devices. In contrast to these shortcomings, the joint efforts of all concerned have today developed electrical control enclosures based on Standards. We find now that the various devices are arranged in a workmanlike manner, and wiring between connecting control panels is much more accessible.

Along with this, there have been improvements in construction of panels and enclosures such as identification of all wiring and devices, gasket and hinge covers, external mounting lugs, and a provision to protect personnel so that the panels cannot be opened unless power is disconnected. Complete electrical wiring diagrams, sequence of operations, and stock lists with appropriate identification cross-referenced with the actual identification on the devices and wiring are now available and accompany the panel.

When breakdowns occur, electricians can detect the cause, make the necessary repairs, and put the equipment back in operation in a minimum amount of time.

One again, I would like to refer to the Cylinder Block Department where our analysis of the equipment required began early in the program. Because of the close coordination with other facilities, it was possible to design a Standard Transfer Section which could be duplicated in varying lengths. The machine tools were located with spaces between them which were even multiples of the Standard Section. This design had a minimum

Quick Change Tools
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of parts and the interchangeability of parts simplified the maintenance job.

Our thinking has changed drastically over a comparatively short period of time. Things which only a few years ago were looked upon as desirable have today become essential. Preventive maintenance, like all other features of a modern production plant, begins in the early stages of planning and takes advantage of the new devices which are available to ease the maintenance burden.

Reallocation of Manpower

Our discussion of the factory with automation brings out the fact that our production processes are becoming much more complicated. We have been successful in many cases in removing that portion of the labor which was largely devoted to manual handling of parts. When we do this, our production processes very often become a series of departments which are in effect one large transfer machine.

When we select the men required to run these departments, we are more concerned with their ability to keep them in first-class condition and to recognize when troubles are threatening.

From this you can see that, in general, your production people will be more highly trained than in the past. The scarce skills are not ready-made. The factory management of the future must be prepared to assist in this training program. The reward to the worker will be that jobs will be less monotonous and boring and that, if properly trained, he will become more interested in his job.

Behind the production worker, we will find more highly trained technical people. The greater complexity of our operating production lines necessitates this.

As we can see from the development of our own Automation Department, a higher skill was necessary in designing the equipment involved than was formerly needed for the comparatively simple devices such as roller conveyors, simple belt conveyors, and other similar items which automation replaced. Specialization among technical people will, in many cases, become more pronounced; but it will be necessary for the various engineering groups to understand the problems of the other departments. Because of this, you will often find the need for supplementary training for the engineering specialists. It is necessary for the automation engineer to coordinate the activities of several different groups in order to obtain a successful installation.

We can sum up the manpower situation in the factory of the future by saying that there will be a much greater use of brain power throughout the entire plant to replace a large portion of the muscle power which we have been accustomed to in the past.

Management

The factory with automation, which now exists in important segments, represents the maturity of manufacturing methods. This maturity which is accomplished by the utilization of the best of engineering thinking has coincided with the greater utilization of specialists throughout the manpower structure of our plants. This, of course, means a larger number of individual departments working on the development and operation of new facilities. With this has come a much greater reliance on detailed studies to obtain all of the facts about proposed modernization and expansion programs.

This combination of factors places a new emphasis on the management of our factories. The top management of our plants must be able to promote team-work in the entire organization in order that all phases of production planning are coordinated. Plant management must keep itself flexible to

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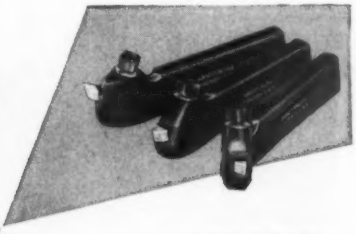

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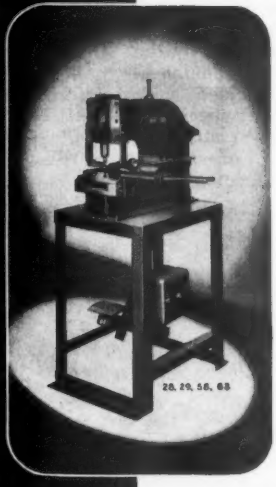
Length of stroke — 1"



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Why rummage through a box full of drills when the Huot Drill Dispenser will keep them sorted by sizes? Each compartment holds many drills—several dozen in the smaller sizes. Beautiful light gray hammerlin baked enamel finish. *Made in three models for fractional, number and letter drills.*

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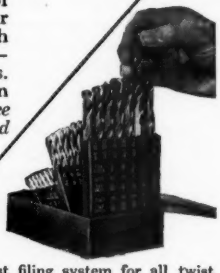
HUOT DRILL INDEX



The simplest filing system for all twist drills. Panels fold into container like pages of a book. Seventeen models for drills from No. 80 wire gauge to 1-inch size.

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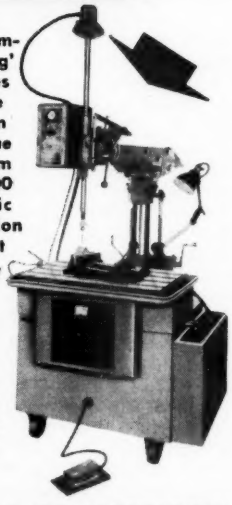

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AUTOMATION AND THE TRANSFER TYPE OF MACHINE TOOL*

by Stanley I. Rice
THE HEALD MACHINE COMPANY
Worcester, Massachusetts

Transfer type machine tools are used where high production is required and where many drilling, boring, reaming, and similar operations are involved. A typical workpiece would be an engine block.

Such a machine is generally set up with a loading station, several work stations and intermediate stations, and an unloading station. A rough part begins at the loading station and is transferred down the length of the machine, stopping at every station where machining operations are performed. Sometimes the part remains idle in intermediate stations.

This type of machine generally consists of a series of separate machines tied together by one long transfer bar which is operated by one or several hydraulic cylinders or equivalent mechanical means. The machine can be divided into sections or units to enable continued production in case of partial machine shut down. This is accomplished by providing a removable link in the transfer bar and by using suitable selector switches to cut out the part of the machine that is down. However, this introduces switching problems and necessitates a duplication of control and safety interlocks.

The hydraulic operation may be initiated from one central hydraulic pump but is generally operated in two or three sections, each with its own hydraulic pump and tank. The hydraulic system will then tie in electrically with the draw bar linkage.

Electrically, each individual section should be a complete machine in itself so that it can be started, operated, and stopped without power to the other sections. Thus the tools at one section may be serviced or changed without operating the other sections of the machine. Selector switches must be arranged so that the operator can change from one section operation to other combinations with a minimum of down time.

On many sections it becomes necessary to use depth-of-cut circuits as, for instance, on a drilling operation that is followed by a boring operation. If the drill does not complete its operation, a broken boring bar is assured in the next station. This is accomplished with a limit switch that operates at the end of the drilling stroke to close a mechanical latching type relay, and with a limit switch that closes with the table in the retracted posi-

. . . *Continued on page 107*

*Presented at the 17th Annual Machine Tool Electrification Forum, sponsored by the Westinghouse Electric Corporation, Pittsburgh, Pa., April 14 & 15, 1953.

The simplest, surest and quickest way to check tolerances and measurements of small tool parts is by projection — with the aid of a Stocker & Yale enclosed-screen Optical Comparator. Several dimensions may be checked simultaneously. And such operations as fine assembly and adjustments may be watched at standard magnifications of 10, 20, 31¼, 50, 62½ and 100 as the operation is performed, to assure a final correct condition independent of dimensions which make it up.

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250 Stocker & Yale Projectors check the quality of General Electric Instruments at their "World Headquarters for Electrical Measurements."

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UNUSUAL PROBLEMS IN MACHINING

by H. H. Whittingham

DETROIT GEAR DIVISION
Borg-Warner Corporation
Detroit, Michigan

It is no secret that present automatic transmissions are probably the most complicated and intricate pieces of mechanism in our automobiles today. Many years of research and development and millions of dollars lies behind the present Detroit Gear Automatic Transmission. Many models were built and long hours of laboratory and road tests conducted. Some models were discarded and others modified which finally resulted in the design now used.

This transmission basically provides three forward speeds and reverse, coupled with a converter which provides the equivalent and ratio spread of four forward speeds. Two of its main features are, first, that it can be arranged to start **automatically** in either first or second gear and, second, the lock-up clutch which, in direct drive, connects the output shaft directly with the engine, thereby eliminating any slip in the fluid member in the direct drive range. This by-passing of the converter in direct drive offers some increased economy and gives a solid feeling in high gear.

The various shift speeds are torque and speed controlled as is customary in fully automatic transmissions. The governor is not of the hydraulic type but a mechanical governor which helps to give a uniform shift pattern regardless of oil temperature.

An outstanding feature is that shifting from gear to gear does not require any "timed" or "cross-over" shifts, i.e., simultaneous engaging and disengaging of clutches or bands. The shifts are accomplished by starting out with all forward bands applied. After shift points are reached, the bands are dropped and the reaction is taken through the over-running clutch. In direct drive for 3rd speed, the drive is direct through a friction clutch to the mainshaft or output shaft. Starting gear is optional 1st or 2nd, depending on the power characteristics of the vehicle in which it is used.

General Manufacturing Considerations

After the original engineering had crystalized and our manufacturing engineers took over, it became apparent that the manufacture of many parts presented a number of problems not normally encountered in our previous experience.

In the initial over-all consideration of the specifications, we found that we would have to manufacture and assemble 330 different part numbers going in the assembly with a tolerence of only ½ gram of foreign matter permitted. Actual current production is averaging about ¼ gram as testimony to the thoroughness of our methods. In relation to the total weight of the transmission, this is one part in 336,000.

The first step was to ensure receipt of exceedingly clean castings, with rigid inspection to see that all core sand, scale and teats were removed. This called for development of improved foundry practices as well as a number of unique cleaning methods to accomplish our goal with reasonable economy. These are largely shot blast cabinets that have

From a paper delivered before the recent SAE National Production Meeting held at Cleveland, Ohio, under sponsorship of the Society of Automotive Engineers, Inc.

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Dangers of distortion and fracture are minimized — pressures reduced to barest minimum because this machine *rolls* the impression into the part.

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been tooled for single purpose operations at various points in the line.

Assembly rooms are all pressurized and air-conditioned. Dust is kept down during working hours by use of a vacuum cleaner to keep floors clean without raising dust and they are washed between shifts each night.

No air hoses, no rags, wood, leather hammers or any fibrous material that can break up into foreign matter that can get into the parts and valves in the transmission, are permited in the assembly room.

All parts are conveyed through the plant, from operation to operation and to the final assemblyline in wire baskets. An adequate supply of these are made up special for each part. They stack easily and are easily loaded onto the tray conveyors. Since they have no closed bottoms, they do not accumulate dirt. They have no wooden pegs from which splinters can peel off to find their way into the transmission. In going through the washing machines, water flows freely not only over the parts but of course through the basket removing all dirt from both. They mean a great saving in handling material and, above all, have so protected our gears, while in the green, as to reduce the well known problem of nicks to the vanishing point.

We also found that we had to remove all burrs to a degree far beyond that normally associated with automotive production. On all parts where there was any possibility of fine hair-like burrs to come loose under operating conditions, we perform many operations to be sure to remove Them. These vary with the part, but the various methods include filing or scraping by hand, wire brushing, stone tumbling, and corn cob and walnut shell blasting.

The requirements of road clearance and compactness of design means holding all diameters down to minimum. Since this transmission must be designed for universal use in the trade, it must meet a wide variety of conditions. One such condition is the high speed engines with which it is now being used in some European cars. Such speeds of 6,000 rpm and more require very careful balancing. Parts that cannot be machined all over such as the two carriers are dynamically balanced on Gisholt Balancing Machines to a tolerance of ½ inch-ounce.

A new level of noise standard is demanded by purchasers of automatic transmissions. All of our gears are pre-shave roughed on Multiple-Spindle Hobbers, or on Shapers where necessary, to close tolerances and are finish shaved. This includes the two internal ring gears. The internal gear of the front pump is broached. In the main gear set, the gears are nitro-carburized in atmosphere - controlled, continuous type furnaces. The ring gears are all quenched in Gleason quenching presses to maintain roundness. We have tooled the gears to bring their mounting locations in close relation to the PD of the gears by the liberal use of Woodworth Diaphragm Chucks locating on the PD's, and grinding holes and diameters to close concentricity tolerances.

Mainshaft

Our mainshaft will probably prove to be one of the most interesting to you. It presented many new and difficult problems to us. It is unusual in that it extends the full length of the unit, from the flywheel to the Universal Joint flange. The shaft must have the strength to absorb the full power output of its engine torque and low gear. It must also be of minimum diameter to hold to a minimum the size of the parts surrounding it. Furthermore, hydraulic pressures to the front clutch, the second speed clutch, and the converter and pressure lubrication to the gears, bearings, and overrunning clutches are all distributed by the mainshaft.

. . . *Continued on page 108*

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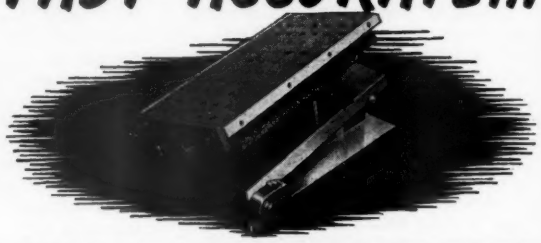

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. . . Automation, from page 103

tion. Only when the full depth of cut closes the latching relay can a circuit be completed through the table-out limit switch to allow the transfer of parts. A latching type relay is necessary, because it will not fall out to cause an improper indication should the operator stop the machine or should a circuit breaker open.

It is generally mandatory to use a circuit that requires the transfer bar to return completely before it makes the forward stroke, and to complete the forward stroke before retracting, even on hand cycle. If allowed to return part way and reverse, it may pick up a part—perhaps because a pawl catches in a hole or because of casting unevenness—and partially transfer it with the inevitable improper positioning or misclamping. To make sure the parts will be clamped before a machining operation takes place we use a limit switch that will close only when the part is exactly in place, and a pressure switch which makes sure of the clamping pressure on the part before a table is allowed to advance. The two switches are wired in series. The pressure switch should be added because a part may be in place but not clamped with sufficient pressure, or may be clamped in a cocked position, either of which may be disastrous.

When the operator at the loading station loads a part properly, a limit switch is

When the machine is to be operated as a divided machine, suitable selector switches must be provided so that a limit switch having a similar function to the loading limit switch, but located at the intermediate loading station, can interlock the transfer system in a like manner.

Originally the electrical conduit connecting the individual legs or work stations was below the fixture and had terminal boxes between each work station. This made it possible to remove any section of the machine, but proved unsatisfactory because all "through" wires had to be disconnected for shipment, and, in spite of proper gaskets and covers, iron dust penetrated the terminal boxes to cause short circuits. These limitations led to the change to the overhead duct-work system with a terminal and push-button box at the rear of each leg. Wires from the individual limit switches, push buttons, and solenoids in each leg are connected back to the terminal blocks. Wires from an individual leg go without a splice or connection from these terminal boxes to the main switch box. This allows for the removal of a leg from either side of a work station without disturbing the wires going to any other leg. It also provides a minimum number of connections, yet with the terminal boxes at each leg, adequate test points are available.

All work stations, insofar as possible, should be interchangeable so that in the event of development of serious trouble in a leg, or of a change in machining sequence, a new station can be inserted or the existing stations interchanged without impossible complications. This allows removal of a work station and replacement of another

. . . *Continued on page 111*

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SIZE	THREAD	SIZE	THREAD	SIZE	THREAD
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5	30-32-36-48-80	7/16	12-16-18-22-24-27-28-30-32-36-40	1-13/16	8-10-12-14-16-18-20
6	36-40-48-56-60	1/2	12-14-16-18-22-24-26-27-28-30-32-40	1-7/8	8-10-12-14-16-18-20-24
7	32-40	9/16	16-20-24-27-28-30-32-40-48	1-15/16	8-10-12-14-16-18-20-24-28
8	24-30-36-38-40-44-48	5/8	12-14-16-20-24-27-28-32-36-40	2	4-1/2-8-10-12-16-18-20
9	24-28-32-40	11/16	11-16-18-20-24-27-28-30-32	2-1/16	12-14
10	28-30-36-40-48-64	3/4	9-11-12-14-18-20-24-26-27-28-32	2-1/8	12-16-20
12	20-28-32-36	13/16	10-14-18-20-32	2-3/16	12-16
14	20-24-28	7/8	10-12-16-18-20-24-27-28-32	2-1/4	4-½-8-12-14-16-18
1/16	60-64	15/16	8-8-10-12-14-16-18-20-24-32	2-5/16	12-18
5/64	72	1	10-12-16-18-20-24-27-32-40	2-3/8	12-16-18
3/32	48	1-1/16	12-14-16-18-20-24	2-1/2	8-10-12
7/64	48-56	1-1/8	8-10-14-16-18-20-24-32	2-9/16	18
1/8	32-40	1-3/16	8-10-12-14-16-18-20-24	2-5/8	12-16-20
5/32	32-36-40	1-1/4	8-10-14-16-18-20-24-32	2-3/4	16
9/64	36-40	1-5/16	12-14-16-18-20-24-32	2-7/8	8-12-16
11/64	36	1-3/8	8-10-14-16-18-20-24	3	8-16
3/16	20-24-32	1-7/16	8-10-12-16-18-20-24	3-1/4	8-12-16
13/64	32	1-1/2	8-10-14-16-18-20-24-28	3-1/2	8-12-16
7/32	24-28-32	1-9/16	18-20-24	3-7/8	8
1/4	18-24-26-27-30-32-36-40	1-5/8	5½-8-10-12-13-16-18-20-24	4	8-12
5/16	16-20-22-27-28-32-40	1-11/16	10-12-14-16-18-20-24		

HIGH SPEED LEFT HAND TAPS

SIZE	THREAD	SIZE	THREAD	SIZE	THREAD
0	80	3/8	16-24-32	1-3/8	6-8-10-12-16-18-20-24
1	56-64-72	7/16	14-20-28	1-7/16	8-10-12-14-16-18-20
2	56-64	1/2	12-13-20-28	1-1/2	6-8-10-12-16-18-20
3	56	9/16	12-18-20-24	1-9/16	8-10-12-16-18-20
4	32-36-40-48	5/8	11-12-18-20-24	1-5/8	8-10-12-14-16-18-20
5	40-44	11/16	11-16-24	1-11/16	8-10-12-14-16-18-20
6	32-36-40	3/4	10-16-18-20	1-3/4	8-10-12-14-16-18-20
8	32-36-40	13/16	16	1-13/16	8-10-12-14-16-18-20
10	24-30-32-40	7/8	9-12-14-18-20	1-7/8	8-10-12-14-16-18-20
12	24-28-32	1	8-12-14-16-18-20	1-15/16	8-10-12-14-16-18-20
1/4	20-28-32	1-1/8	7-12	2	4½-10-12
5/16	18-20-24-28-32	1-1/4	7-12-16-18		

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. . . Unusual Problems, from page 105

The shaft is made of cold-extruded bar stock of SAE A-8645 specification. The bar stock is heat-treated at the mill to 19-24 Rockwell "C". The subsequent cold working increases the hardness to 38-32 Rockwell "C". The only subsequent heat treatment is localized induction hardening.

The cold extrusion process is very economical as it leaves a minimum amount of material to be removed. One turning operation controls size for subsequent grinding.

In order to distribute oil pressure, as mentioned, it is necessary to drill a 14″ hole through the center of the shaft. The tolerance in this three-step hole is 0.001″ in order to hold the two valves which are assembled into it. This hole is drilled in a five-spindle special Barnes Gun Drilling Machine. The drills are held stationary and the part is rotated at 1500 rpm. Using two machines, one operator can produce 52 pcs/hr. Originally we planned to ream this hole. We experienced considerable trouble holding the three steps to size with the reamers as well as attaining any reasonable reamer life. As so often happens, necessity became the mother of invention. We tried gun drilling to size and found that we got better finish and closer tolerance with the gun drill alone.

As previously mentioned, the only heat treating on this part is induction hardening which is required at three points only, on bearing diameters. It was undesirable to heat treat the shaft all over as toughness was desired in the other sections and, due to its shape, straightening was most certainly to be avoided. The hardening is done in a two-section #1400 Detroit Thermonic High Frequency Unit Induction Heater. In the one station the shaft is rotated and fed through the coil and quenched by the so-called scanning method. An interruption when half-way through the coil produces the two sections of heat treatment. In the other station, the shaft is rotated only and immediately quenched in place. Due to the various holes and grooves in the shaft, it was necessary to control length of heat treatment and depth very carefully. These are held within 0.035″ to 0.050″ for depth and +⅛″, —0″ for length. Hardness obtained is 60-63 Rockwell "C".

The grinding of the bearing diameters is done on Landis Grinders. Five diameters are ground at one time. There is no longer anything too unusual about this operation, except that its success depends on the design and accuracy of the wheel dresser. These diameters are held to 0.0005″ parallel.

Another unusual operation is the securing of the two valves in the shaft. One valve is aluminum die casting and the other a bronze die casting. These are relatively soft. Originally, we pressed the valves into the hole, using a lubricant, but scratches thus produced caused oil leakage which affected the functioning of the transmission. We finally solved this problem by submerging the valves in liquid nitrogen (—80°) which produced a shrinkage of about 0.001″. This permits the valves to practically drop free into the hole and, when they thaw out, we have a metal to 0.001″ press fit. No leak occurs at high oil temperatures, as the valves expand more than the steel and, consequently, tend to seal tighter as temperatures rise.

Planet Carriers

The two planet carriers are of conventional design and are made of malleable iron. Milling of the pinion slots is done on a special Cross Milling Machine, milling one of each carrier at a time while two are being loaded. There is automatic indexing for each of the slots. The fixture itself is mounted on a turntable which indexes 180°. We are using carbide milling cutters and are holding the slots to 0.001″ parallel in **one** operation. No further operations are made on the slots.

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The three pin holes in these carriers are held to 0.002″ on centers between each other and the center of the splined hole, and 0.0012″ in 2″ for parallelism and 0.001″ on hole size, which is common in all planetary gearing. We found the most efficient spindle drill heads precision-made to close tolerances and then bore these holes with precision-made cluster heads, boring two pieces at a time with a production of 104pcs/hr.

We have found the precision-made cluster boring heads to be superior to indexing methods due to the fact that when their center distances are established they can be maintained, and the problem of maintaining the indexing mechanism with its wearing parts is eliminated.

Other Components

The transmission case is machined on a progressive type of transfer equipment, which is today considered more or less standard equipment. The first operations are performed on Davis Rotary Mills, followed by Bausch Transfer Equipment in three stages. 217 operations are performed by three men assisted by one set-up man. The presetting of tools on the Cross Tool-O-Meter reduces change-over time to a minimum. The main bores are qualified on Heald Diamond Boring Machines operated in pairs, and the final operation is to finish face both front and rear ends which are held square with the bore and parallel to each other within 0.002″ TIR. This is accomplished on a Bullard with a production of 47 pcs/hr.

Next Month — 7th Annual PRESS DIES & STAMPINGS Feature Issue

The governor, rear pump and speedometer drive are housed in a separate casting and the servo cylinders are mounted on the sides of the case. In order to prevent leakage at these joints, extreme flatness is required. The faces of all these castings are ground on a Besley-Bowen Grinder. Flatness is held to within 0.003″ TIR. We are loading one set of fixtures while the second set is being operated. The action of the grinding wheel itself is such that it is self-dressing. Net production is 141 pcs/hr.

The front pump is of the conventional internal-external gear design and no special machines are being used. We rough out the pump body on a Type "K" Bullard Multi-Matic, and the gear pockets are precision bored on Healds, holding the depth to 0.002″ and flatness to 0.001″.

In order to hold pump pressure and volume, the end play between the pump gears and the cover must not exceed 0.002″. Originally we made selective fits in assembling the pump gears in the body. Experimentation showed that it was much more economical to lap the pump gears to a 0.0002″ to 0.0003″ tolerance and eliminate the selective fitting. This is done on a Norton lapping machine with net production of 200 gears/hr.

The front sun gear is riveted to the lock-up drum. At the riveted joint we must maintain a seal adequate to hold 80 psi operating pressure. We use six rivets to assemble these parts, which require the rivets to be inserted in one direction and riveted in the reverse direction. This originally presented an expensive operation due to the inaccessibility of the holes. The rivets were coated with heavy grease to hold them in place while the assembly was turned over and riveted. Through the help of the Detroit Power Screw Driver Company, we were able to develop a machine in which we load the two parts into a fixture and the rivets are hopper fed to their positions and staked sufficiently to hold them in place while the assembly is turned over for riveting. This is done on a shuttle-type die in a conventional crank press and all rivets are upset simultaneously. This method has proven very successful from a production and cost standpoint.

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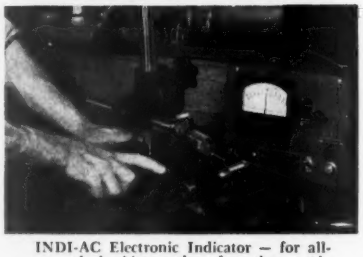

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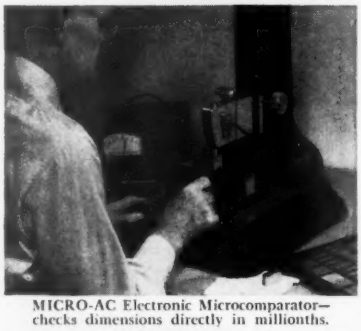

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Next Month—7th Annual
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. . . Automation, from page 107

with minimum shut down time of the entire machine.

The wires from both sides of every limit switch are brought back to the main switch box so that continuity tests of each switch circuit can be made at the main switch box. It is considered good practice by some engineers to provide indicating lamps so that the operator may check visually whether any limit switch is open or closed.

Although an **increased** amount of wire is added to the machine, it facilitates service to an extent that justifies the added cost. Each individual limit switch is installed with flexible conduit to allow its physical removal from the machine without disconnecting the wiring. This allows manual operation of the limit switch circuit and makes for ease in replacing faulty switches.

An operator's control, provided adjacent to the operator's station, contains the cycle start button, safety stop button, and other buttons to control the main functions of the machine, as well as indicating lights.

In addition, cycle off-on selector switches are provided at each leg so that the service man can kill the automatic cycle, while working on a machine leg, to eliminate the possibility of an accidental starting of the machine by the operator. A steel cable running the entire length of the machine is connected to a limit switch which will shut down the entire machine in case of emergency.

Any push buttons used for operations not normal to the machine are provided with lock and key. These push buttons, for instance, may allow an authorized person, during set-up purposes, to move a part down the length of the machine without normal interlocks.

Several methods of numbering or coding wires have been studied with the result that current use has a wire number preceded by the station number and letter (i.e. wire 2L6 means No. 2 lefthand leg wire No. 6). With this system the destination of wires is known, and wires to different sections of the machine, yet which perform the same duty, can have the same suffix with the identifying leg as a prefix. Wires general to the control but not identified to a particular station are numbered consecutively with a prefix "C".

To facilitate wiring of the machines, and as a help in trouble shooting when multiple panel control boxes are furnished, it has been suggested that the color of jumper wires between panels in the electric box be different from that which is used for wires going from panels to machine. The J. I. C. recommends use of red wire for all 110 volt a-c circuits, which leaves the machine builder no leeway in providing additional colors for wires which, in his opinion, by color coding would make for easier wiring and servicing.

One automotive company does provide an optional requirement to J. I. C. that states that "recommended color code be used **inside** the control panel, and additional colors, to facilitate identification, **may** be used between control panel and devices on the equipment." This does not provide for use of another color for jumper wires between panels.

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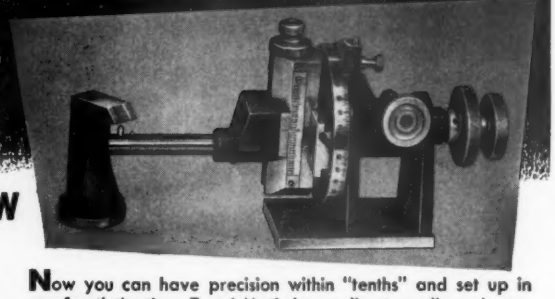

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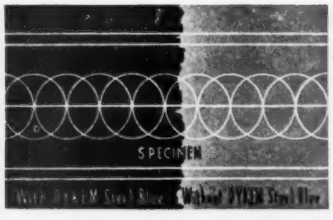

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Cooperation + Follow-up = Excellent Safety

A safety program, to be successful, must enlist the voluntary and enthusiastic support of a company's supervisors and employees. Once complete cooperation has been achieved, the constant vigilance which locates and corrects unsafe conditions will become effective. The problem in many plants has been the gaining of supervisory cooperation without creating antagonism or resentment. Foremen and supervisors often feel that safety in their departments is a job they can handle without the help of anyone. There is much truth in that assumption. Most problems of safety can be solved from within the department. There remain, however, some problems which do require the attention of specialists. More than that, foremen being only human, sometimes lose sight of the importance of the safety program as a day-in-and-day-out function.

To restate the problem, then — How best to make safety an ever-present thought in the minds of supervisors without arousing antagonism on the one hand or complacency on the other? The Timken Roller Bearing Company, in a serious effort to solve this human and mechanical equation, has developed a system that merits careful attention. Here is how it works:

In September 1952 a safety committee of supervisors from the machine tool, metallurgical, sheet metal, maintenance, pipefitter, electrical and millwright departments was organized. The superintendent of the Maintenance department is chairman of the committee.

Committee meetings are set up for Wednesday mornings at 9:00 and held fortnightly. In conjunction with the Wednesday morning session, an inspection tour to a different department every two weeks is included.

Entirely informal and friendly in its approach, the group meets with the general foreman of the department visited during the preceding session. A frank and open discussion of safety problems observed by the group in its tour ensues. The general foreman meeting with the committee joins the discussion offering his suggestions and thinking on the subject under consideration. Item by item is dealt with in the order established by the committee. Remedial action is planned right then and there. Prompt and efficient follow-up is assured since the safety committee is staffed with the very men who would be obliged to correct the unsafe conditions anyway.

To each safety problem on the committee's agenda is attached a note describing the action taken. As long as a safety problem has not be adequately remedied, and to the committee's satisfaction, that item stays on the committee's agenda. This assures proper follow-up action until it can be removed from the agenda.

At the conclusion of these departmental safety tours, each member of the committee submits his notes taken during the tour to the secretary of the committee. The notes are then checked to eliminate duplication, and placed in proper sequence. By the Monday following the Wednesday tour, the committee secretary will place in the hands of the committee, the general foreman of the department visited and top members of the operations management, mimeographed copies of the notes. The general foreman and the committee then have approximately a week and a half to correct those unsafe conditions noted by the committee. So that this safety job is done correctly and expeditiously, the general foreman receives the total and unqualified cooperation of the safety committee.

Next Month — 7th Annual PRESS DIES & STAMPINGS Feature Issue

Although the Timken Roller Bearing Company has had an excellent safety record for a long time, the work of the safety committee is seen as an even further improvement. Sharing full credit with the safety committee, of course, is the permanent safety department. The safety department, established at Timken many years ago, is, in a substantial measure, responsible for the fact that the company has the lowest industrial compensation rate for an industry in its class in the state of Ohio.

CORRECTION

WHISTLER ADVERTISEMENT APRIL FRONT COVER

By error the Whistler U-375 Adjustable Perforating Die Set was incorrectly priced at $280.00. The correct special introductory price effective November 1, 1952 is $324.80.

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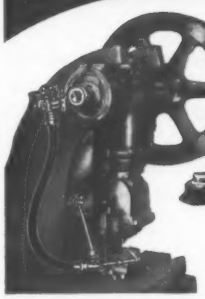

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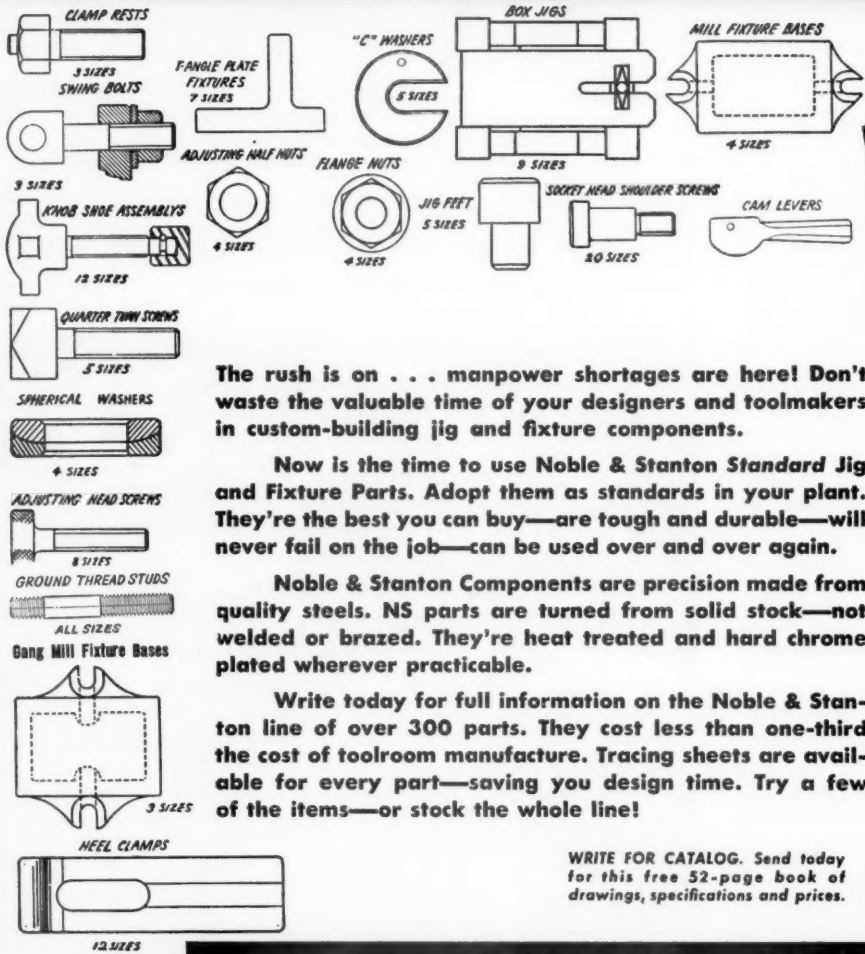

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1	17	32	66	81	96	107	118A	124C	130D	137A	142C	145A	149A	152G	155C
2	18	33	67	82	97	108	118B	124D	130E	137B	142D	145B	149B	153A	157
3	19	34	68	83	98	109	119A	125A	131	137C	142E	145C	150A	153B	158
4	20	35	69	84	99	110A	119B	125B	132A	138A	142F	145D	150B	153C	
5	21	36	70	85	100	110B	119C	126A	132B	138B	142G	146A	150C	153D	
6	22	37	71	86	101	110C	120A	126B	132C	138C	143A	146B	151A	154A	
7	23	38	72	87	102A	110D	120B	126C	133A	138D	143B	146C	151B	154B	
8	24	40	73	88	102B	111	122A	126D	133B	139A	143C	146D	151C	154C	
9	25	41	74	89	102C	112A	122B	127A	133C	139B	143D	146E	151D	154D	
10	26	61	75	90	102D	112B	122C	127B	133D	140A	144A	147A	152A	154E	
11	27	62A	76	91	103	112C	122D	128A	134A	140B	144B	147B	152B	154F	
12	28	62B	77	92	104	113A	123A	128B	134B	140C	144C	147C	152C	154G	
13	29	63	78	93	105	113B	123B	130A	136A	141	144D	147D	152D	154H	
14	30	64	79	94	106A	114	124A	130B	136B	142A	144E	148A	152E	155A	
16	31	65	80	95	106B	117	124B	130C	136C	142B	144F	148B	152F	155B	

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3	19	34	68	83	98	109	119A	125A	131	137C	142E	145C	150A	153B	158
4	20	35	69	84	99	110A	119B	125B	132A	138A	142F	145D	150B	153C	
5	21	36	70	85	100	110B	119C	126A	132B	138B	142G	146A	150C	153D	
6	22	37	71	86	101	110C	120A	126B	132C	138C	143A	146B	151A	154A	
7	23	38	72	87	102A	110D	120B	126C	133A	138D	143B	146C	151B	154B	
8	24	40	73	88	102B	111	122A	126D	133B	139A	143C	146D	151C	154C	
9	25	41	74	89	102C	112A	122B	127A	133C	139B	143D	146E	151D	154D	
10	26	61	75	90	102D	112B	122C	127B	133D	140A	144A	147A	152A	154E	
11	27	62A	76	91	103	112C	122D	128A	134A	140B	144B	147B	152B	154F	
12	28	62B	77	92	104	113A	123A	128B	134B	140C	144C	147C	152C	154G	
13	29	63	78	93	105	113B	123B	130A	136A	141	144D	147D	152D	154H	
14	30	64	79	94	106A	114	124A	130B	136B	142A	144E	148A	152E	155A	
16	31	65	80	95	106B	117	124B	130C	136C	142B	144F	148B	152F	155B	

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A2	A14	A26	B10	B22	B34	B46	B58	B70	B82	B94	C1	D1	E12
A3	A15	A27	B11	B23	B35	B47	B59	B71	B83	B95	C2	E1	E13
A4	A16	A28	B12	B24	B36	B48	B60	B72	B84	B96	C3	E2	E14
A5	A17	B1	B13	B25	B37	B49	B61	B73	B85	B97	C4	E3	E15
A6	A18	B2	B14	B26	B38	B50	B62	B74	B86	B98	C5	E4	E16
A7	A19	B3	B15	B27	B39	B51	B63	B75	B87	B99	C6	E5	
A8	A20	B4	B16	B28	B40	B52	B64	B76	B88	B100	C7	E6	
A9	A21	B5	B17	B29	B41	B53	B65	B77	B89	B101	C8	E7	
A10	A22	B6	B18	B30	B42	B54	B66	B78	B90	B102	C9	E8	
A11	A23	B7	B19	B31	B43	B55	B67	B79	B91	B103	C10	E9	
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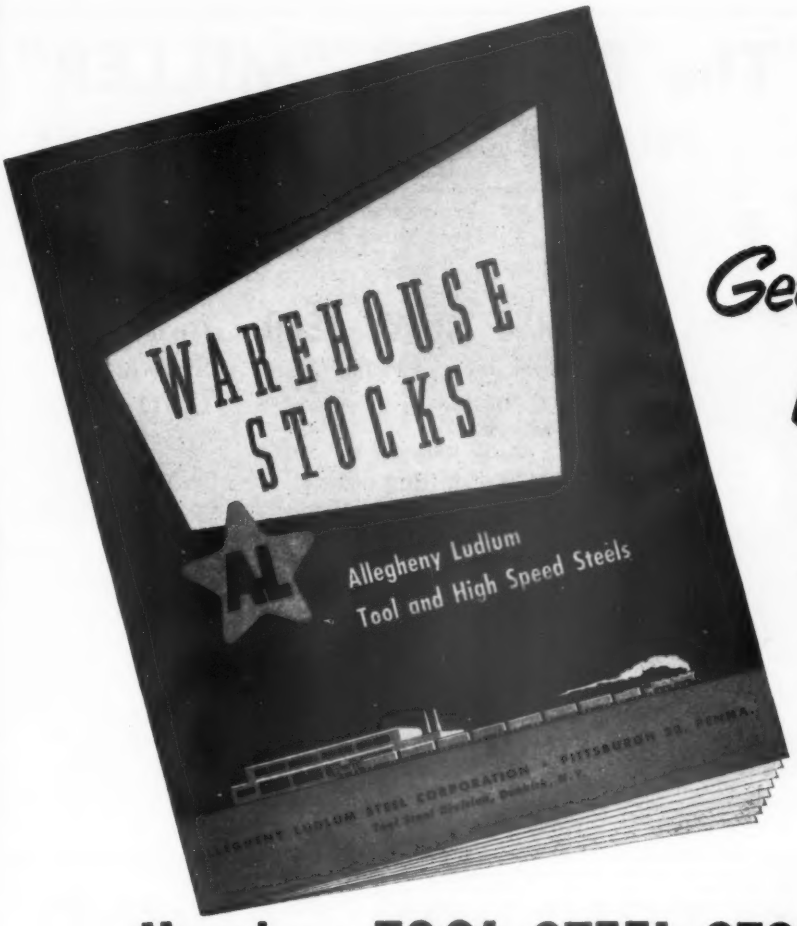

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Rotoblast Table Sharply Reduced Breakage of Fragile Castings

Installation of a single rotoblast table at the Woodruff & Edwards Inc. foundry in Elgin, Illinois, meant a 50 per cent reduction in casting breakage; 163 per cent increase in production; cleaner castings; lowered noise level; improved working conditions; and more usable floor area.

Photos courtesy Pangborn Corp.

Fig. 1. These obsolete tumbling barrels were overdue for replacement on several grounds, including adverse effect on working conditions.

Formerly, eight tumbling barrels were used to clean fragile castings. Now, with the new table, breakage has already been reduced approximately 750 lb per day. The usual run of work at the Elgin foundry includes miscellaneous gray iron castings which average about 10 lb in weight. Recent typical jobs include: transmission housings, beauty parlor rinse bowls, electric range tops, washing machine gear boxes, small machine tool parts, sprockets, fan bases, floor and roof drain castings and sump pump parts.

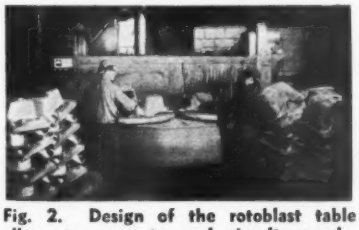


Fig. 2. Design of the rotoblast table allows two men to work simultaneously. One man loads castings at the same time the other unloads the finished pieces.

Production figures show a marked increase since tumbling barrels were replaced with the table. The old equipment was operated at the rate of 1.32 tons of castings per man-hour. After the new table had been operating only 30 days, the rate had climbed to 1.52 tons per man-hour. It rose twice more before leveling out: 2.68 tons during the second month; 3.47 during the third month, and has leveled off at this rate, a 163 percent increase in production!

Fig. 3. Small castings can be cleaned just as effectively in the cleaning table. The finished piece at the right shows how thoroughly cleaning is done.

Design is responsible for some of the difference in production. Tumbling barrels were loaded with a batch of castings and started in motion. After the castings were fully cleaned, each barrel was stopped and unloaded. In contrast, the rotoblast table allows continuous operation, one work station is exposed for loading while the others are in the operating cycle.

The 9-ft unit is made up of a 9-ft diameter revolving main table with six 36-in. auxiliary tables which revolve on their own axes to bring all exposed surfaces (horizontal and vertical) into direct contact with the blast stream. The rotoblast stream, hurled from a 45-degree angle with the work, and the revolving action of the auxiliary tables make it possi-

. . . *Continued on page 125*

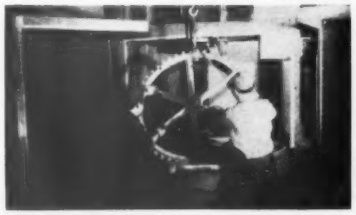
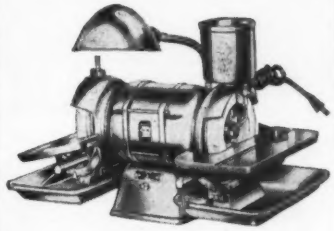


Fig. 4. The versatility of the cleaning table is shown by its ability to handle this large sprocket casting.

Baldor

Carbide Tool Grinder
For Precision Work



Short wheel and bearing centers, heavy shaft, large ball-bearings, dynamically balanced armature and weight-balanced wheels provide rigidity and smoothness necessary for precision work, ½ hp, 3400 RPM reversible motor. $142.60 complete.

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Fast, Accurate Measurements
With the AMIC "Quick-Action"
Vernier Caliper

AT NEW LOW PRICES

The perfect tool for machine shop, tool room inspection and Quality Control. A flick of the thumb and you've got your external and internal dimensions. Knife-edged hardened jaws provide exact thread measurements. A depth gage blade gives speedy measurements. AMIC designed and made exclusively for AMIC by an outstanding European manufacturer.
Scientifically engineered, painstakingly machined, packed in a sturdy leatherette case. A tool without rival
Size 6" No. 21B, Graduation 1/40", vernier reading .001.
No. 22B, Graduation 1/40" and full MM, vernier reading .001 and 1/10 MM.
Write for Circular A. Dealers inquiries invited.

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to hold open wiring, etc., in position
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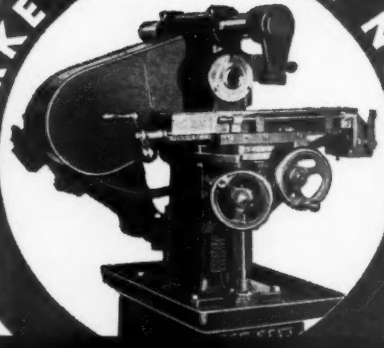

Send for complete data on models attachments, accessories and suggestions for putting Burke's to work for your profit.

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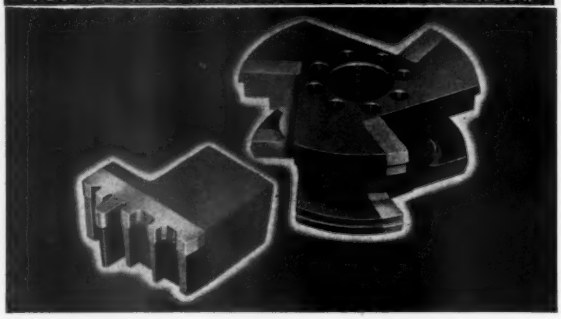

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Carbide Form Tools
Flat or Circular

• Fully equipped with the most recent developments in carbide grinding machinery, WELDON is able to produce a practically unlimited range of complicated shapes in flat or circular form tools to special order. *Send us your specifications.*

Weldon distributors throughout U.S.A. and Canada carry complete stocks to serve you.

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QUICK-PIC CATALOGS

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AUTOMATIC TRANSFER

This new Motch & Merryweather bulletin has graphic data on a line of automatic transfer machines. Design gives many plus-efficiency features, saves floorspace, cuts labor and tooling.
Circle Inform-A-Gram No. E1.

SHAFT MOUNTED REDUCTION

"Shaft-King" is name of a new series of 20 to 1 ratio speed reduction units described in this 20 page catalog. Fit any machine, compact, wide range, multi-purpose. Important eng'g improvements.
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PRESS BRAKES

Airtherm "Metalworker" press brakes are subject of this new bulletin, which has complete specifications and data on a light and heavy capacity range. Illustrated; tabular selection data.
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REMELT STEELS

Specifically developed for remelting; stainless, "super" stainless and alloyed tool steels are described in this brochure. This is a new service for the up-to-date precision casting foundry.
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ADVANCED HEAT TREATING

100% forced convection heat treating units are discussed in this new bulletin. Includes diagrammatic operations scheduling, has all specifications and data on special furnace features. Ipsen.
Circle Inform-A-Gram No. E5

HI-TORQUE CLUTCHES

Fo'der describes a line of overrunning, indexing and backstopping clutches which have a very high torque capacity for size and weight. Special "sprag" design. Application and engineering data included.
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PRESS BULLETIN

"Warco" straight side double crankpresses are described in this new piece of literature by Federal Machine & Welder Co. Full data and engineering drawings, plus photos and specification tables.
Circle Inform-A-Gram No. E7

JIG SAVINGS

High drill jig savings are possible with the "anchor bushing" described in this bulletin. Full application and engineering data given, photos and drawings. Simpler, easier, more interchangeable/alterable.
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PIPE THREADING

This Oster manual describes pipe threading machines featuring automatically gripping chucks. One model will thread pipe after it has been bent, working with high speed and accuracy. All data.
Circle Inform-A-Gram No. E9

HI-SPEED STAMPINGS

This new bulletin tells complete story of the Multi-Slide automatic machine for producing high-speed high-precision stampings; cutting down on secondary operations. Specifications given on four mods.
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TOOLROOM GRINDERS

A range of toolroom grinders are featured in this new Boyar-Schultz manual. Features are listed compactly. #6-12 surface grinder is totally new machine with small machine cost and big performance.
Circle Inform-A-Gram No. E11

DRILL GRINDER

The Dumore drill grinder is fully featured in this new bulletin. It features ease of operation and complete accuracy with point and clearance angle selection for best cutting in all materials.
Circle Inform-A-Gram No. E12

CARBIDES COLLECTION

This new 56 page carbide catalog has just become available, shows a complete line of tools and blanks. Also has 12 pages of valuable information and engineering data for the carbide user. Don't miss.
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SPACE-SAVING CYLINDERS

An entirely new line of high-pressure hydraulic cylinders is shown in this new S-P catalog. 10 illustrated pages show 11 different models, also contain much useable technical information.
Circle Inform-A-Gram No. E14

"O" RING GAGES

Reliant dial indicator gages detailed in this new catalog will perform almost any internal gaging requirement with speed and accuracy. Catalog contains data on a wide model type/size range.
Circle Inform-A-Gram No. E15

UNIVERSAL MILLER

New George Gorton catalog has eight pages of illustrations, information and data on the #3-34 universal milling machine. This catalog is commendably well put together, gives clear features picture quickly.
Circle Inform-A-Gram No. E16

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR INFORM-A-GRAM KEY NUMBERS

HERE'S THE "tap miser" YOU'VE BEEN WAITING FOR!

Helps eliminate costly tap breakage shut-downs and excessive work spoilage!

Breaking too many taps?—Tap life shortened?—Spoiling many pieces?—Then check your tapping equipment. Investigate PROCUNIER Tapping attachments. Whether it's continuous or intermittent tapping in soft or hard metals—large or small hole jobs with skilled or unskilled operators—you will find Procunier Tapping machines performing with a new-found ease, a more dependable and consistent accuracy and providing many **extra** hours of tapping efficiency. Procunier Tappers include: cover clamping and quill models mount rigidly eliminating chatter and vibration; new, sensitive double-cone friction clutch automatically regulates driving pressure with a soft "cushioned" action; ball-bearing heat treated gears with special reversing mechanism; unique tap holding spindle support; aluminum housing; plus other important features.

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The exclusive Procunier "Tru-Grip" tap holder is lighter, smaller in diameter. Eliminates "chewed" tap shanks.

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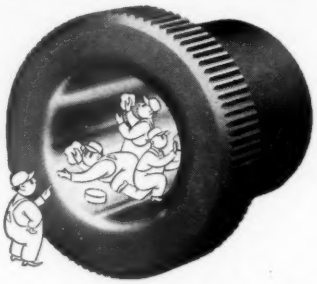
SUPER FINISH OF UNIVERSAL DRILL BUSHINGS reduces tool wear to a minimum



One sure way to cut excessive tool wear in your operations is to specify Universal Drill Bushings because their superfinish bores help reduce wear on production tools to an absolute minimum, especially in close tolerance work. The blended radius on the top inside diameter helps prevent tool hang-up and breakage. 100% concentricity and hardness tests insure accuracy, uniform high quality and long life. Knurled heads provide a quick, sure grip. Universal Drill Bushings are produced in a complete range of standard sizes and lengths. Orders for special dimensions will receive prompt attention. For complete information, write to the office nearest you—Universal Engineering Sales Co., 1060 Broad St., Newark 2, N.J.; 5035 Sixth Ave., Kenosha, Wis. — or our home office.

UNIVERSAL ENGINEERING COMPANY
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Here in a compact, self-contained unit you have the high precision that has found so prominent a place in the jet engine program. Used at machine or bench, it has self-aligning features assuring accuracy. "Just right" for Statistical Quality Control programs.

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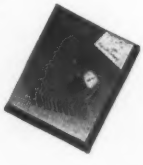

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Drill Hardened Steels without Annealing –

With the new, improved "HARDSTEEL" Drill, you can do accurate, smooth drilling, countersinking, counterboring and reaming in steels hardened by any process without first annealing the work. And they work with equal ease on work-hardening steels and high carbon—high chrome steels of any degree of hardness.

"HARDSTEEL" Drills fit standard drill presses. They save time and reduce rejects. They permit engineering changes requiring additional drilling after hardening. And parts drilled after hardening always match at assembly.

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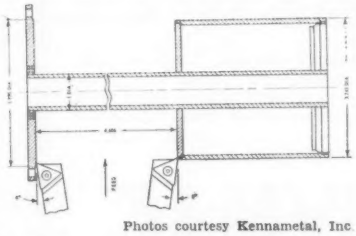
Expendable Carbide Insert Tool Provides Double Tool Life

Achievement of superior surface finish together with extended tool life is being experienced by a noted manufacturer of precision communication and recording equipment in machining SAE C-1118 steel at 1000 surface feet per minute using standard Kendex tungsten carbide triangular insert tools.

As performed at the McElroy Manufacturing Corporation,



Photos courtesy Kennametal, Inc.

Littleton, Mass., the operation consists of facing two surfaces of a high frequency transmitter component from a maximum of 4 inches in diameter down to a 1-inch diameter center shaft as shown in the sketch. Work is performed on a ¾-horsepower Logan lathe having a variable drive attachment.

A mirror-like finish is required on the machined surface because it is later plated with a 0.0002-inch thickness of copper over which a 0.0012 inch silver plating is applied. Surface is then buffed down and rhodium flashed to prevent tarnish.

Variable Drive Unit Actuated by Tool Slide. — To obtain the necessary machine finish a surface foot rate of 1000 is maintained throughout the cut. This is done by varying the revolutions per minute from 1000 at the start of the cut to approximately 4000 at the finish by a variable drive unit attached to the Logan lathe and actuated by the tool slide which is fed in at

. . . Continued on page 125

NOW! JIFFY Carbi TIRES

STANDARD EQUIPMENT ON

DELTA CRESCENT BAND SAWS

Delta Crescent 20" Band Saw

Proof of Acceptance . . .

Delta-Crescent has joined the ranks of *leading* band saw manufacturers using CARTER Jiffy Tires as standard equipment because . . .

- Jiffy Tires can be changed in 10 minutes
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MODEL 11FA AND MODEL 11FB

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- Anti-back-up Pawl Locks Table Against Rearward Motion.
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- Adjustable from 4 to 24 Index.
- Working Parts Flame Hardened, Completely Enclosed.

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"M" TEMPER ALLOY STEEL

for maximum machinability and minimum heat-treat distortion. It has great toughness at high degrees of hardness and long-wearing properties for lowest unit cost. For complete information on HY-TEN alloy steels, write for FREE DATA BOOK.

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RAYMAC Solid Carbide DRILLS and REAMERS

RAYMAC drills cut hardened metal . . . do not burn or anneal. Feature operational speeds of 350 to 600 RPMs depending on size and hardness of metal.

RAYMAC solid carbide reamers are custom designed for individual jobs. Our engineering department is at your service to solve your reaming problems.

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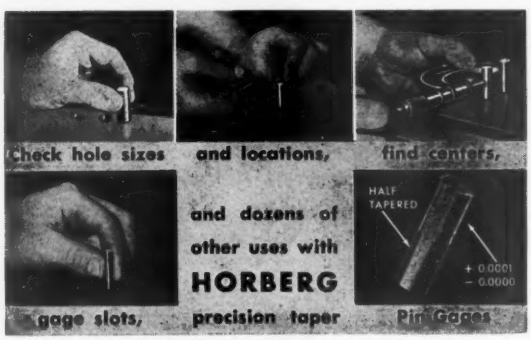
RAYMAC

MANUFACTURING COMPANY INC.

3729 CASS AVENUE, DETROIT 1, MICH.



SAVE TIME AND MATERIALS

Oil-hardened tool steel tapered pin gages accurate to + 0.0001" − 0.0000" insure dependable sizing and location of holes and slots for machinists, set-up men, tool and die men, inspectors, all who need precise hole measurement.

CONCENTRIC TAPER on lower half of each gage fits holes 0.0012" smaller than standard letter, fraction, and number size drill holes. Makes insertion easier. Permits gaging of odd-size holes and slots.

ALL GAGES are 1½ inches long. Sets contain a pair of each size in a plastic case with 4-place decimal equivalents of each size plainly marked.

ALL ITEMS STOCKED FOR IMMEDIATE DELIVERY

THE Horbery GAGE COMPANY

Quantity 29 STAPLES ST., BRIDGEPORT, CONN.

..... Letter sets @ $45. 52 gages (A-Z)
..... Fraction Sets @ $30. 60 gages (1/64" to ½" in 1/64" steps)
..... Number Sets @ $90. 120 gages (1 to 60)
..... Single gages @ $ 1.
..... Stand alone @ $10.

Please Rush checked items and literature to

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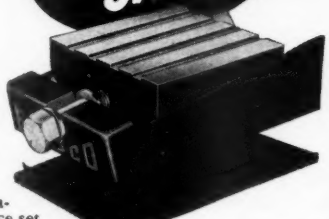
Here's how to SAVE TIME in SETTING-UP and KEEPING your MACHINES LEVEL

Fast
Accurate
Self-Aligning
Machine Leveler

Empco JACK



Empco Jacks enable you to meet hurry-up demands for relocation of machinery by giving you the fastest, easiest, most accurate machine leveling ever known: you simply raise or tilt machine sufficiently to allow the Empco Jacks to be slipped under base. The number of jacks required depends on weight of machine and size of base. Once set on Empco Jacks, the entire operation of leveling and maintaining equipment level is quickly done. By applying a wrench to the "hex" head of adjusting screw, an adjustment is obtained either up or down until your level indicator reads "zero." Write for specifications and prices today.

Vibration absorbing mounting pads increase machinery life.

EMPCO PRODUCTS

THE ENTERPRISE MACHINE PARTS CORPORATION

2735 JEROME AVENUE • DETROIT 12, MICHIGAN

. . . Rotoblast Table, from page 119

ble to handle work with deep pockets, intricate contours, and multi-surfaces with great cleaning effectiveness.

Cleaner castings have been the result because of this ability of the blast stream to reach all surfaces. A lower noise level and decreased dust are other benefits of the table. These factors mean definite improvement in working conditions. The atmosphere of the cleaning room has changed for the better.

Next Month
7th Annual
PRESS DIES & STAMPINGS
Feature Issue

Installation of a cleaning table has released 36 per cent of the floor area devoted to cleaning equipment. Formerly, the barrels took up 256 sq ft but the rotoblast table only requires 150 sq ft. The entire area has been made more usable than before. This, in turn, increases the efficiency of the cleaning room.

A definite reduction in time of operation was also noted. The same load of castings that took 3 hours in the tumbling barrels, now takes only 12 minutes on the table.

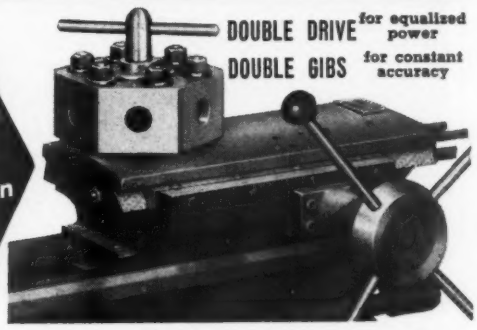
. . . Expendable Carbide, from page 123

0.0045-inch per revolution. As shown in the photograph a chip guard is used to assure that the finish machined surface will not be scratched.

At a lower surface foot rate a satisfactory finish could not be obtained; while at the higher speed tool life became a problem. Best tool life received with several grades of triangular inserts first tried on this job was only 20 pieces per cutting edge or 60 pieces per insert.

Now, with Grade K8 inserts (most abrasive-resistant grade of Kennametal) 60 pieces are faced with each of the three available cutting edges or 180 pieces per insert. Since depth of cut is only 0.007-inch, the Kendex inserts of left- and righthand tools are interchanged to machine an additional 180 pieces. A total of 360 pieces are faced after which the expendable Kendex inserts are replaced with new ones thus eliminating all tool grinding expense on this operation.

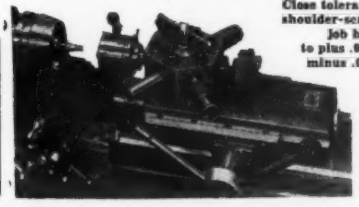
Enco Self-Indexing HEXTURRET
For Lower Production Costs and Speedier Output



DOUBLE DRIVE for equalized power
DOUBLE GIBS for constant accuracy

√ Custom built to fit all lathes from 9" to 18".
√ Smooth, sensitive control with Pilot wheel drive through twin gears and racks.
√ All bearing surfaces hand scraped.
√ All parts of indexing mechanism hardened, assuring accuracy.

Manufacturers of the most complete line of HEXTURRET BED TURRETS, TURRET TOOL POSTS, and TAILSTOCK TURRETS in the country.



Close tolerance shoulder-screw job held to plus .002; minus .000.

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A product for every PORTABLE GRINDING job!

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You can choose from over a dozen products by CARBORUNDUM for portable grinding of all types.

CALL YOUR CARBORUNDUM SALESMAN OR DISTRIBUTOR for experienced counsel and prompt delivery from complete stocks. Or write to us at Dept. TP 81-39A.

CARBORUNDUM
TRADE MARK
the ONLY source for EVERY abrasive product you need

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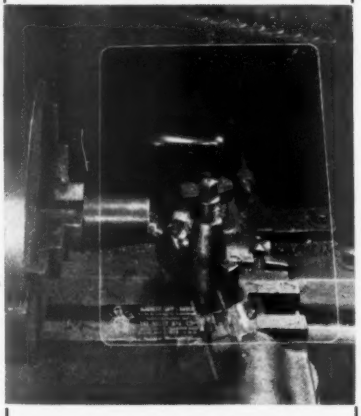
81-39A

Here's Turning Point Protection For You

The men of skill—America's modern machinists deserve the best . . . the most practical . . . the handiest . . . the safest machinery guards. Skilled machinists in the plants of our hosts of satisfied customers guard the *turning points of their machinery with Dilley Guards.*



Look at the picture. Note the tru-vision thru these sturdy plastic guards . . . magnetically-instantly positionable on any machine. Let today be your turning point to proven . . . effective . . . modern guarding. Literature on request, or order six 8"x10" units today.

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DRILL THESE HOLES

BY A QUICK, EASY, INEXPENSIVE METHOD

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WATTS BROS. TOOL WORKS

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MR. MANUFACTURER

If you manufacture drilling and tapping equipment or allied lines and are looking for a real live-wire representative specializing in the above field, to cover industrial Chicago and surrounding territories, write TOOLING and PRODUCTION, Box 553, 1975 Lee Road, Cleveland 18, Ohio.

Mechanization Increases Foundry Problems

In speaking before a discussion group at the last Plant Maintenance Show, Stephen E. Kelly, assistant general manager of Eberhard Mfg. Co., listed four problems faced in the foundry business that have developed in proportion to the increase in machanization of the industry.

1. The more machinery there is, the greater the chance for breakdowns.

2. Breakdowns can now cause from 10 to 24 or more molders with connected laborers to be on "down time."

3. Such "down time" rapidly expands non-productive labor costs.

4. Consequences are more serious today than ever before because of the attitude of much foundry labor and also because of the height reached by foundry labor rates.

A vital factor in the solution of these problems is the practice of Preventive Maintenance. Such practice, according to Mr. Kelly, can:

1. Very directly affect cost by
   a. Keeping direct and indirect labor at reasonable productive cost level.
   b. Keeping mechanical replacements low.
   c. Maintaining high production schedules.
2. Help preserve customer good will by meeting delivery dates.
3. Can directly aid in keeping maintenance force efficiently low in number. It is easier to maintain than replace.
4. Be of material aid in maintaining employee morale through keeping workers on incentive time rather than the lower down-time rate.

KUTMORE ADJUSTABLE **HOLLOW MILLS**

DESIGNED FOR **ALL** YOUR HOLLOW MILL WORK

- ANY COMBINATION OF . . . TURNING . . . TAPERING . . . FACING . . . CHAMFERING . . . TREPANNING IN **ONE PASS.**
- EXCLUSIVE **MICROMETER** ADJUSTMENT FEATURE FOR RAPID SET-UP.
- CUTTING CAPACITIES FROM 1/32" TO 2" DIAMETER IN STANDARD STOCK.

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Get A Better **"Surface Grinder"** Job at Less Cost

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RADIUS DRESSER $39.00

Diamond $7.00

Hardened shaft — Bearing adjustable for wear. Diamond always perfectly centered. Easily set adjustable 180° stops.

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SPECIAL 20" Wheel Size $110.00

ANGLE DRESSER $44.00

Diamond $7.00

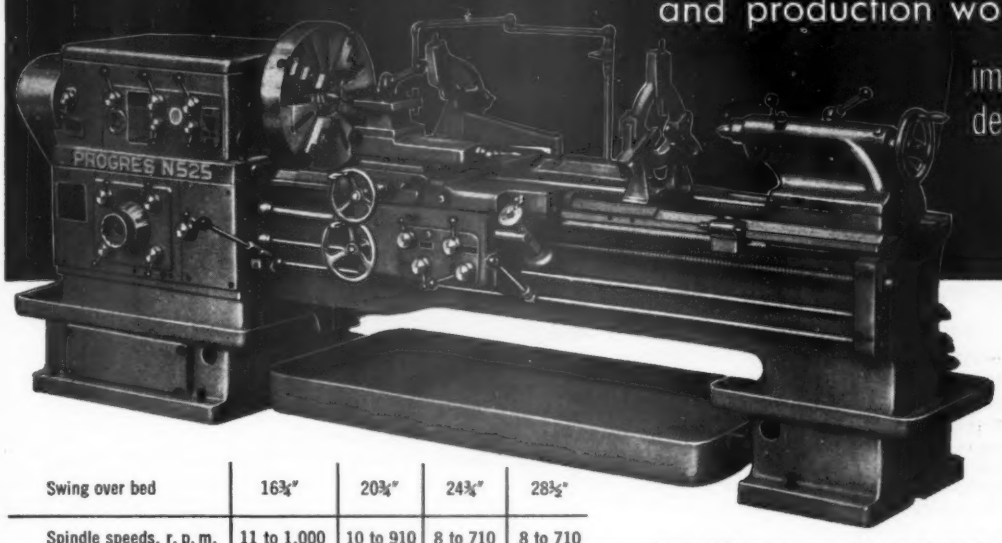
Ball Thrust Bearings. 24 Precision Ground Surfaces. Can be set very accurately with a Protractor. Works underneath the wheel. Large bearing surfaces.

The "MIGHTY MIDGET" Line

SPERMAN METAL SPECIALTIES • 1085 ROGERS AVE. • BROOKLYN 26, N. Y.

PROGRES lathes for tool room and production work

immediate delivery



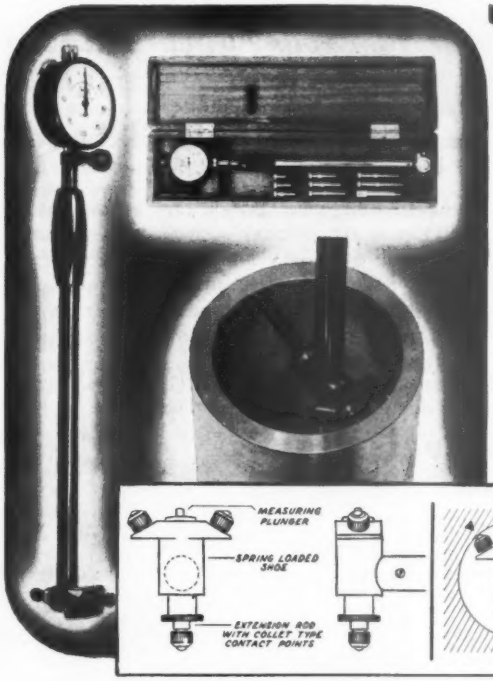
Swing over bed	16¾"	20¾"	24¾"	28½"
Spindle speeds, r. p. m.	11 to 1,000	10 to 910	8 to 710	8 to 710

Over 100 put in operation in the U. S. A. last year.

write or phone for full details

Parker Machine Company, Inc.

158 PIONEER ST., BROOKLYN 31, NEW YORK • TRIANGLE 5-2103 and 2157

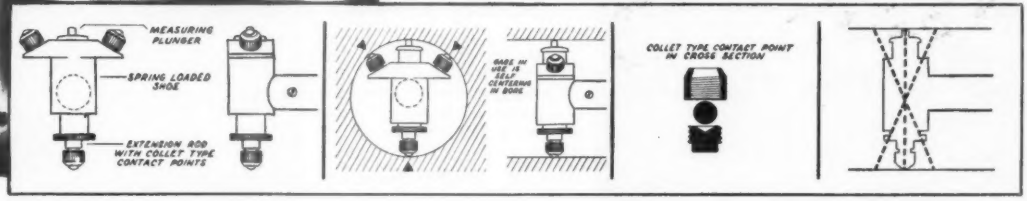


TUMICO DIAL INDICATOR

Small Bore and Cylinder Gages

● Tumico Cylinder Gages are designed to give fast, accurate bore measurement without the use of costly plug gages. Actual bore variation is shown directly on the Dial Indicator. They are efficient and easy to use. Based on the accepted principle in cylinder gaging, they use a fixed point in conjunction with a spring loaded shoe to assure self-alignment in the bore. They give accurate results in half-thousandths of an inch, ten-thousandths of an inch, hundredths, or thousandths of a millimeter, depending on the indicator used.

Collet type contact points are used on extension rods and shoe (Fig. 3). When, after continuous use, flats appear on 3/16" balls, unscrew collet and rotate ball to a new face or replace ball completely. Range of size measures 1/2" to 36" bore and to within 3/16" of bottom of a blind hole. All models supplied complete in instrument cases. Write for catalog.


MEASURING PLUNGER
SPRING LOADED SHOE
EXTENSION ROD WITH COLLET TYPE CONTACT POINTS
GAGE IN USE IS SELF CENTERING IN BORE
COLLET TYPE CONTACT POINT IN CROSS SECTION

To use, rock measuring points over axis of bore (Figure 4). This shows minimum or actual indicator reading from true perpendicular position in bore. Variations such as oversize, wear, ovality, taper, etc., are shown at once. To measure actual size of cylinder bore, set gage to size with cylinder of known diameter or use micrometer measurement over the fixed and moving measuring points.

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No. 1
PROFILE GRINDER

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No. 1 Profile Grinder is ideal for many other grinding tasks where set-up on other machines is not practical such as grinding cams and templates to scribed lines and in removing flashing and gates from plastic parts.

For larger, heavier work, use our No. 2 Profile Grinder.

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High speed spindle with pre-loaded ball bearings turns at 20,000 R. P. M. Stock removal is rapid, even with small diameter wheels. Vertical oscillations of ⅛" provide even wheel wear. Accommodates wheel sizes, ⅛" to ¾" diameters.

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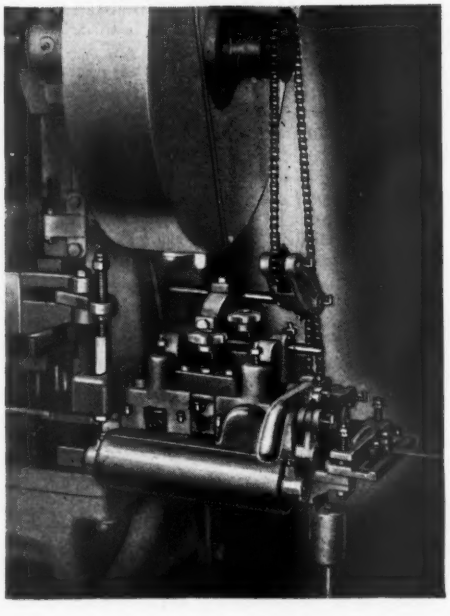
WITTEK Automatic Roll Feeds



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Automatic ROLL FEEDS AND REEL STANDS WMCo

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THREAD MILLING ENCYCLOPEDIA

What is believed to be the first complete and up-to-date manual on thread milling and thread milling cutters is now available from Detroit Tap & Tool Company, 8615 E. 8-Mile Rd., Base Line, Michigan. Printed in two colors, the manual (D-52) gives complete technical information on thread milling, speeds and feeds, maintenance, inspection and tolerances, milling cutter types, also catalog information.

Tables listing correct peripheral speeds for milling different materials under different work conditions, and methods for determining cutter speeds and feeds are given in the manual. A table showing rpm for various diameter cutters is listed. Correct cutter sharpening practice is described in detail with illustrations. Standard thread milling cutter tolerance charts are included as an aid to cutter selection. Tables of standard keyways and taper shanks are listed and a check list of 16 items given to aid in ordering cutters. Specification tables shown for standard blanks.

Circle Inform-A-Gram No. C1.

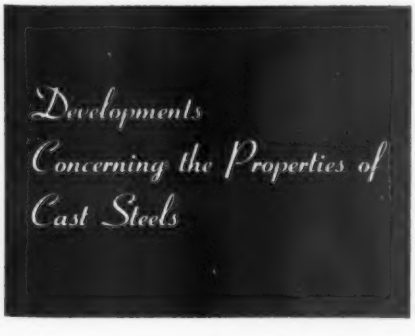
Factual Data On Typical Metalworking Jobs is presented in the new 80 page edition of the booklet "Cutting and Grinding Facts" by Sun Oil Co., Philadelphia 3, Pa. By comparing their own operations with those outlined, executives, superintendents and foremen will discover ways to speed production, improve finishes, and prolong tool life. Operational data is supplied by leading machine builders. **Circle C2.**

SOURCE FOR WELDING AIDS

Production and maintenance men, metallurgists, and others interested in welding methods will find a wealth of technical information on the welding of stainless, low-alloy high-tensile, and non-ferrous metals in a booklet just issued by the Arcos Corp., 1500 So. 50th St., Phila. 43, Pa. It is designed as an index and a guide to a series of bulletins, charts, and articles prepared as working tools to facilitate welding and aid those responsible for plant welding practices to attain consistent quality results.

Some of the technical information listed as available: Selector chart for meeting Army, Navy, and AMS specifications. Selector chart for welding high strength low alloy steels. Application chart, with data describing 56 different electrodes. Booklet on the "ABC's of Welding High Tensile Steels." Chart on stainless steel wire selection for automatic welding.

Circle Inform-A-Gram No. C3.



This Brochure Contains Test Results of some of the exhaustive studies of cast steels properties under different treatments which have recently been undertaken by the Steel Founder's Society of America, 920 Midland Bldg., Cleveland 15, Ohio. It has in semi-summarized form a vast amount of information that will be equally useful to purchasers, engineers, and designers in the castings field. **Inform-A-Gram No. C4.**

A 66 Page Booklet On Quenching, better practices and methods, is now available from E. F. Houghton Co., 303 W. Lehigh Ave., Phila. 33, Pa. Outlines process, deals with familiar and advanced practices. **Circle Inform-A-Gram No. C5.**

Hard Rubber & Plastics Handbook by American Hard Rubber Co., 93 Worth St., New York 13, N. Y., gives exhaustive data on applicability of this versatile material to your product, has all machining and technical data. **Circle Inform-A-Gram No. C6.**

It's Possible to Reduce Your Inventory for single point tools as much as one third with the new plan announced by Carboloy Dept. of G. E. Co., Detroit 32, Michigan. 11 specially selected standards. Get full data now! **Circle Inform-A-Gram No. C7.**

"Proper Care of Punches & Dies" is title of wall chart for tool and stock room by Cleveland Punch & Shear Works Co., St. Clair & E. 40th St., Cleveland 14. Compact, valuable, attention-getter. **Circle Inform-A-Gram No. C8.**

Hints on Temperature Determination in post-forming decorative formica are given in latest data sheet from Tempil Corp., N. Y. **Circle Inform-A-Gram No. C9.**

58 Pages of Engineering Drawings on fixtures comprise the latest clamp assembly and fixture catalog by Lodding Inc., Worcester, Mass. This brochure is invaluable, should save a vast amount of time. **Circle Inform-A-Gram No. C10.**

Alloy Steel Properties for gas turbine structures are described in a brochure from Great Lakes Steel Corp., Ecorse, Detroit 29. Tabular properties, fabrication, and temperature behaviour data. **Circle Inform-A-Gram No. C11.**

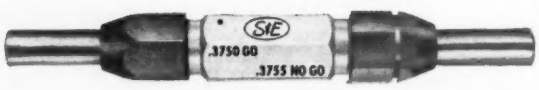
How To Cut With Portable Power Saws is subject of a new booklet from Skil Corp., 5033 Elston Ave., Chicago 30. Blade selection and cutting techniques for more than 30 different materials. **Circle Inform-A-Gram No. C12.**

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR INFORM-A-GRAM KEY NUMBERS

S&E Tungsten Carbide

PLUG GAGES

REVERSIBLE TYPE



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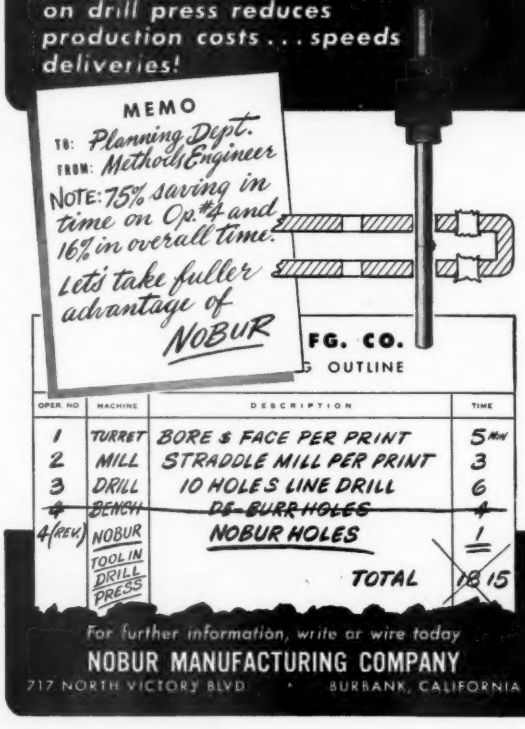
on drill press reduces production costs . . . speeds deliveries!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TO: Planning Dept.
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. . . Band Tools, from page 59

having its characteristics for cutting a specific material or a group of materials, provide as a whole a very adequate choice of set dimensions. Some materials require that tooth tip be first extra hard and secondly retain a certain degree of toughness, however, with other materials this rule may be reversed to advantage. If the band has been selected on the basis of all essentials concerned, the slotting operation will be a success and optimum production consistent with quality and tool life will combine to make it so. No need trying to obtain all three factors at their extremes and at the same time, since one or two factors must be de-emphasized to obtain the best in a third factor.

Cutting rates on ferrous metals vary from 0.125 to 6.00 square inches per minute depending on type, thickness and cut surface finish requirement. Considerably higher cutting rates are of course possible on non-ferrous metals. As a matter of fact, accurate slots may even be cut in hardened steel, extremely hard, or high temperature alloys without heat distortion or penetration. Such slotting operations require a "Line Grinding" band. A band machine such as shown in Figure 6 has been designed for modern band tools.

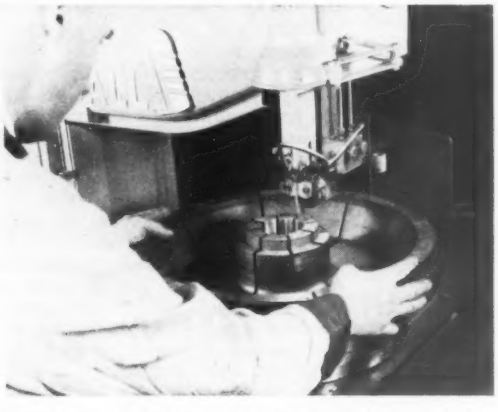

Fig. 6. The Contour-matic band machine and Line Grinding band combine to provide industry with a revolutionary cutting technique, and slotting is but one of the many applications for this process. Since it is now possible for the first time to precision grind internal and external contours in a vertical position, tremendous savings are regularly being effected in salvaging broken dies and other parts or to correct shrinkage in heat treating.

Whether it's a new slotting job or that the production cost of a slotting operation is actually too high by conventional procedure, the DoAll Research Laboratory is prepared to advise as to the possibilities of band machining and will further cooperate to bring per unit cost down to its lowest possible figure.

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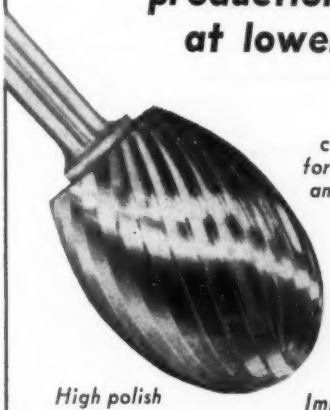
better, faster production at lower cost



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job-engineered, master-machined

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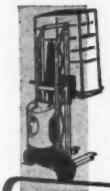

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. . . Automatic Factory, from page 101

make the best of the various technical skills available for planning purposes.

The Future of Automatic Processes

We have installed successful systems in many of the Divisions of the Ford Motor Company. We have gone as far in the Cleveland Engine Plant as it was practical to go at the time the plant was developed. In several cases, we have not hesitated to set up departments with automation throughout. We have been in operation for nearly a year and the results so far have been entirely satisfactory.

The use of transfer machines and automation are with us because they are a necessity to keep our costs down. To forecast the future, we can only call upon our present experience and our current successes. The history of automation in the past few years, we believe, is a sound basis for forecasting future developments. As we pointed out, it was only a few years ago when our processing was on the basis of a series of individual machines each doing one small operation. Our automation engineers devised means of tying these standard facilities together so that manual handling could be eliminated in many cases.

As these earlier systems were developed, it was apparent that a broad field was opening up which would change our entire concept of production. The machinery builders started to produce machines in cooperation with the automotive industry that were designed with automation in mind.

In our Cylinder Block Department, we have seen how it has become one large transfer machine with no material handlers. Our operators are at essential operations only and skilled mechanics are available to maintain the system on the basis of preventive maintenance. In many cases, our current installations are the latest of their type to be found anywhere.

The use of automation in our manufacturing plants is a trend which has started and which we feel will continue and expand. The future will certainly find a much greater use of the knowledge which has been obtained within the past few years. We are certain that increased management attention, engineering thought, and coordination will keep this trend going and extend it substantially for the maximum benefit to all.

We have seen how it is possible to reduce our Direct Labor while at the same time calling for higher skills to serve our production lines, and how we can reduce the damage to parts by automatic handling as well as increase the speeds of our machines and produce safer operations.

We have discussed the disadvantages which are often brought up when automatic equipment is discussed. We believe that these disadvantages have been solved and that the advantages in proper installations far exceed them.

The future of automatic processes is inseparable from the future of our manufacturing industries in the constant fight to reduce cost so that consumption of our manufactured goods may be increased, and our employment may remain at a high level. The future of automatic processes at the Ford Motor Company is assured based on our experiences so far. The future looks promising and there is no industry which can afford not to consider the possibilities.

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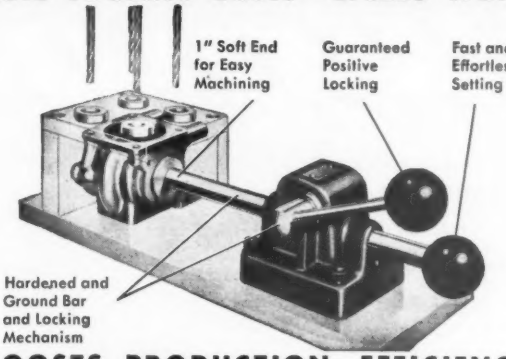
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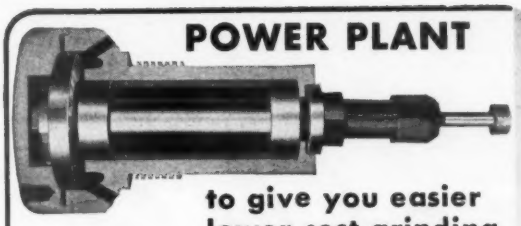

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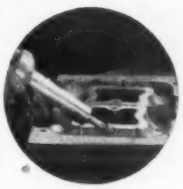

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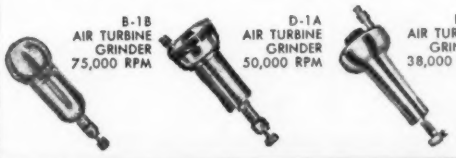

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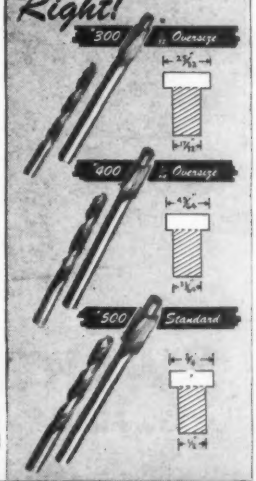

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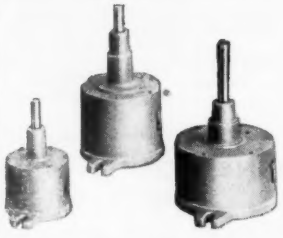
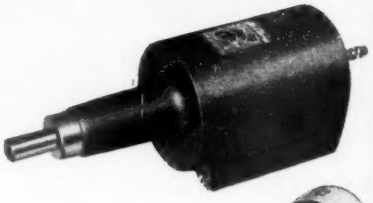


Bore	STROKES Horizontal	Vertical
1″	5/8″	1″-2″
2¼″	1″-2″-3″	5/8″
3″		½″-2″
4″	2″-2½″	3″
5″	3″	3″
6″	3″	2″



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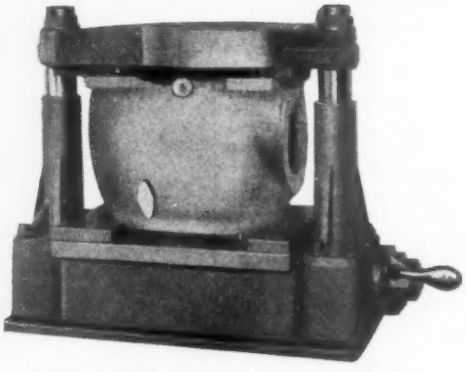

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WITH PLAIN ADAPTERS

FIXTURES CAN BE USED AGAIN ON SUBSEQUENT TOOLING PROGRAMS.

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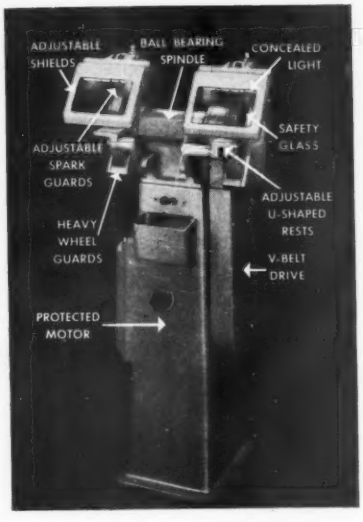
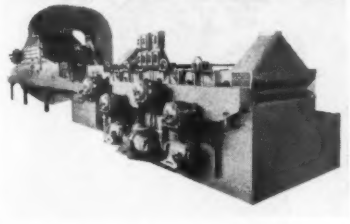
This New Pedestal Tool Grinder by South Bend Lathe, South Bend 22, Indiana, is built for ease of



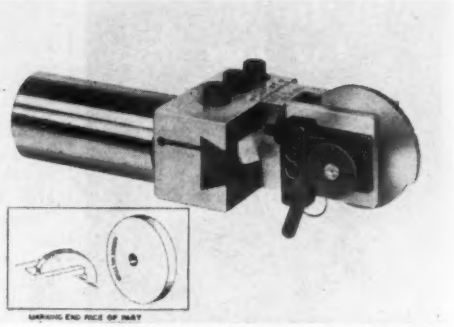
operation and trouble-free maintenance. Supplied with either 8″ wheels and ½HP motor or 10″ wheels and ¾″ HP motor.
Circle Inform-A-Gram No. A1.

Designed for the Application of Lubricants to sheets and blanks, this new 'Drawcote' machine is announced by Gilron Products Co., 6007 Euclid Ave., Cleveland 3, Ohio. It combines with the advantages of Drawcote, the company's new dry lubricant, to reduce stock preparation costs and speed production in many metal forming operations. Material can be pro-



cessed through this machine at speeds up to 55 feet per minute. Three separate operations are performed. A washer unit with rotary brushes cleans both sides of the stock. Cleaned stock enters the coating unit which will handle blanks up to 48″ wide. After coating the stock enters the drying element. The dry coated material is clean and easy to handle.
Circle Inform-A-Gram No. A2.

New automatic roll marker is designed to mark the end faces of parts during the machine cycle on automatic or hand operated screw machines, bench or turret lathes, etc. It eliminates secondary marking operations. A sketch of a typical marking set-up is shown at the lower left hand side of our illustration.



A new marking device for screw machines, which permits die marking of part numbers, patent numbers, etc. on the end face of parts during the machine cycle, has been added to its line of automatic roll markers by New Method Steel Stamps, Inc. 147 Jos. Campau, Detroit 7, Michigan. The fixture is suitable for both light and heavy work, and will mark the end face of parts on any diameter of face of 1½″ and up.

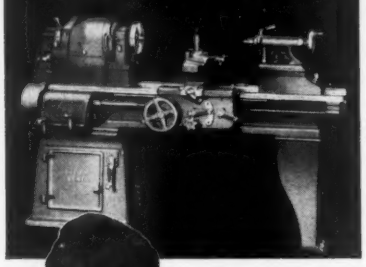
The marker eliminates the need for separate set-ups for marking; reducing cost, scrap, etc. Easy disassembly of the marker for rapid interchange of lettering rolls is possible by removing two conveniently placed Allen head cap screws, the entire control shaft and roll die mechanism coming off as a complete unit. This can usually be done without resetting the holder in the machine. The marker will use either solid dies or interchangeable type in roll holders if desired. Design is simple for minimum maintenance, easy setup.
Circle Inform-A-Gram No. A3.

Contour and Timing of Engine Camshafts are inspected by this new camshaft comparator from Vinco Corp., 9111 Schaefer Highway, Detroit 28, Michigan. Engine camshafts are checked off against a master cam to determine the variances in the cam contour of the part. The master cam is ground and lapped to an accuracy of .0001″. Cam contour variations are shown on a .0001″ dial indicator and simultaneously recorded on a linear chart. Dial indicator and chart readings are identical and

will repeat within .0001″. Cam lobe and keyway timing errors are shown on an inbuilt, Vernier equipped graduated plate and the timing check is accurate to within one minute of arc. Although the instrument is tooled for an individual camshaft, a wide variety of work sizes can be accommodated. Camshafts that are similar in all respects, except cam contour, may be inspected by making minor changeovers. Major tooling changeover, requiring up to 1½ hours of set-up time, is required for entirely different camshafts.
Circle Inform-A-Gram No. A4.

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR INFORM-A-GRAM KEY NUMBERS

CAPACITY
FOR BIG JOBS!
ACCURACY
FOR ANY JOB!



16-24" x 6' Quick Change Gear Lathe

South Bend 16-24" Lathe

Here's a lathe with a versatility that makes equipment dollars go further. Its 24" swing provides the capacity for handling a variety of large diameter, medium weight jobs whose size would otherwise require large, heavy lathes. This extra capacity is achieved without any sacrifice of accuracy in the machining of smaller work. Having an unusually wide range of spindle speeds, all sizes of work can be machined at effective cutting speeds. The improved South Bend two lever gear box permits instant selection of power feeds for any turning, facing, or thread cutting operation. A complete line of chucks, tools and attachments simplifies the tooling for this lathe. *Write for catalog* on the 16-24" South Bend lathe.

SOUTH BEND LATHE • South Bend 22, Ind.
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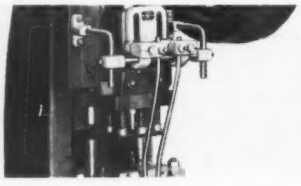
SOUTH BEND LATHES

This New Parts Cleaning Brush is made by the Howell Device Co., 8311 Maywood Ave., Cleveland 2, Ohio, and is excellent for cleaning chips, etc. from machines and dies.

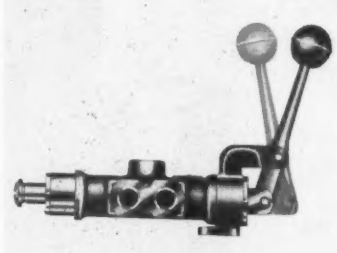
It is rust, spark, and warp proof, its bristles are made from a specially treated fibre which will not "mush" or soften. They are set in a refill holder held in place by one screw that can be changed almost instantly as necessary. **Circle Inform-A-Gram No. A5.**

Press Sweep Guard. By Cooper-Weymouth, Inc., 277 Noble Ave., Bridgeport 8, Conn., this guard fits to presses to 4" stroke. The



two guard arms are actuated by the ram and sweep the operator's hands away from the danger area as the ram descends. Visibility is unimpaired. **Inform-A-Gram No. A6.**

This New Air Control Valve by Valvair Corp., Akron, Ohio, has two speed controls built into the valve body. Its principal use is to control the stroke of an air cylinder. The advantages of the built-in controls are: no purchase



or installation of separate speed controls; simpler pipping than required with separate control units; cost saving of over 50% offered by this design. Available in a standard four way piped exhaust model; production currently in the 3/8" pipe size. Control assemblies to actuate the valve are: knob, lever, clevis, treadle, foot, cam, cylinder, solenoid and diaphragm. **Circle Inform-A-Gram No. A7.**

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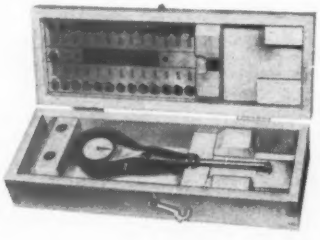
marking rough castings, machinery, etc. Comes in handy applicator tube with ball point attachment. Six colors available. John P. Nissen, Jr. Co., Glenside, Pa.
Circle Inform-A-Gram No. A8.

As a Development of its Small Bore Gage, Standard Gage Co. Inc., Poughkeepsie, New York, announces complete sets of centering size discs whereby this gage



can measure any bore within its overall range of ½" to ⅜". Previously it had been furnished as a "singlehole" gage for one specified dimension.
Circle Inform-A-Gram No. A9.

This Optical Instrument is specially designed for measuring entrance angles of wire drawing dies,

is announced by American Optical Co., Instrument Div., Buffalo 15, N.Y. Unskilled operators, with only a few minutes instruction can check to an accuracy of plus or minus 10 minutes of arc.
Circle Inform-A-Gram No. A10.

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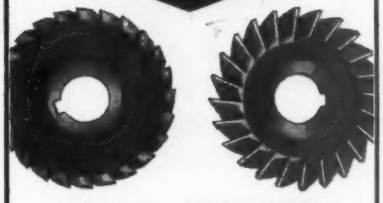

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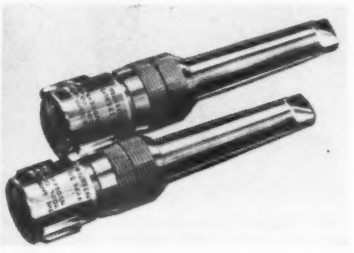
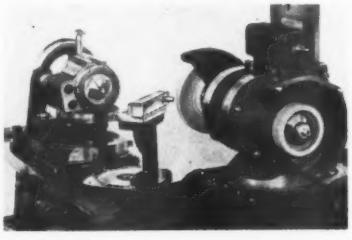
1436 E. MAUMEE · ADRIAN, MICHIGAN

A Floating Reamer has just been added to the line of machine tools produced by the Wickman Mfg. Co., 10325 Capital Ave., (Oak Park) Detroit 37, Mich. Blades may be sharp-



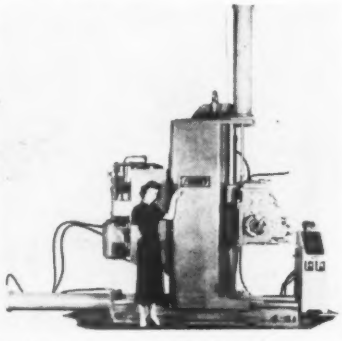
ened or renewed and the floating action is constant and effective through full reamer range. Types are available for standard or blind holes, 14 sizes from ¾" to 4" inclusive. **Inform-A-Gram No. A11.**

This New Angle Dresser, announced by Royal Oak Tool & Machine Co., 29800 Stephenson Highway, Royal Oak, Mich., is inexpen-



sive and simple in operation. Can be used on practically any cutter and tool room and OD grinder, has a graduated base and 5 minute vernier to permit precision set-up and dressing. **Inform-A-Gram No. A12.**

This New Machine Handles complicated, irregular profile milling and boring of aluminum, magnesium castings and forgings, cast and rolled armor plate. It's developed by Forney's, Inc. New Castle, Pa.



It features a spindle housing as a motor powered unit which moves directly into the work face. Company engineers state that this makes work more accurate and gives more power and rigidity to the cutting tool. **Circle No. A13.**

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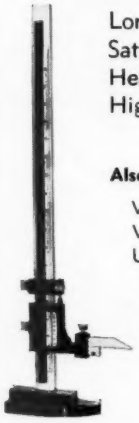
precision
HEIGHT GAGES
12" to 36"



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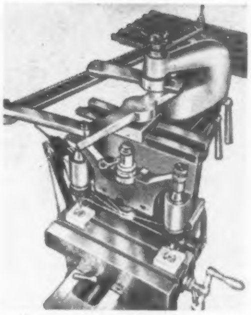
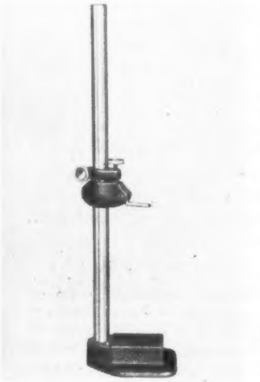
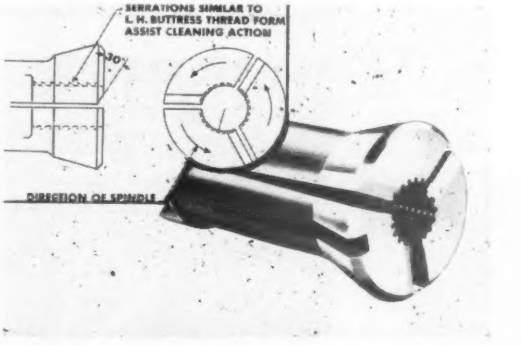


Two Spindle Engraving Machine. To double the production of engraved parts, J. Arthur Deakin & Son, 150-28 Hillside Ave., Jamaica 2, N. Y., has introduced this new machine. Its pantograph transfers the engraving movement from one master to two copying spindles, which are held by a unique spindle support. Two rigid roller slides, working at right angles to each other, provide the movement for the spindles. This construction permits extreme spindle sensitivity and produces highly accurate engraving. Both cutters are set in the same plane. Spindles can be adjusted instantly and equally to equalize the depth of cut. Coarse and fine adjustments for both spindles are controlled by a single lever.
Circle Inform-A-Gram No. A14.



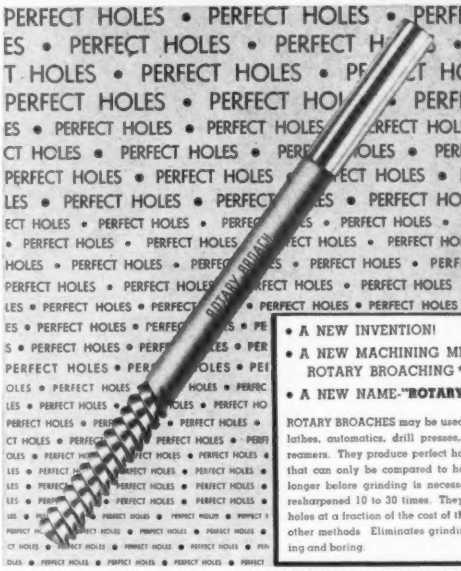
This New Height Gauge was recently introduced by H. E. Dickerman Mfg. Company, Springfield, Mass., to supplement its regular models. Incorporating design features which make it quickly adaptable for use as a height gauge, comparator or scriber, it is available in column lengths of 18″ and 24″. Greater post diameter and flanged base contribute to accuracy and stability in sustained gauging, inspection, or quality control operations. **Circle No. A15.**

New Self-Cleaning Collet has recently been introduced by Sheffer Collet Co., Traverse City, Michigan. The collet is designed for use on automatics, turret lathes and other machines where the collet is used in a rotating spindle. Coolants and cutting oils, along with solids picked up by the solutions, collect in collet



slots forming a sludge and clogging the collet and chucking and feeding mechanisms. It also works along the collet tube to the rear of the spindle where it dilutes the lubricants and damages the machine. Felt wicks used in the slots have proved only partially effective in alleviating this condition. On this collet, the self-cleaning feature consists of an inclined plane on the following edge of each slot face. Instead of an edge collecting foreign matter, the angular surfaces act as fan blades forcibly repelling it.
Circle Inform-A-Gram No. A16.

PERFECT HOLES



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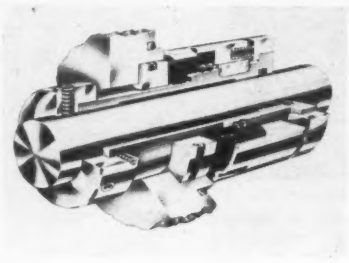
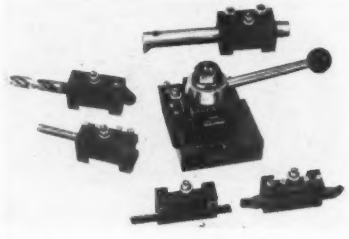
Heavy-Duty Type Balanced Mechanical Seal which will withstand pressures up to 1000psi is now being offered by Crane Packing Co., Dept. T-12, 1800 W. Cuyler Ave.,



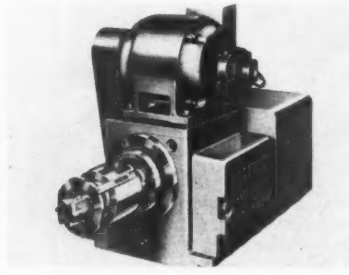
Chicago 13, Ill. Extremely compact design adapts it for use in conventional pump stuffing boxes. To insure peak efficiency mating faces of the washer and seat are precision lapped to .0000232". **Circle Inform-A-Gram No. A17.**

This New Tool Post Fits All Lathes regardless of style of compound rest top. It is made by Aloris Tool Co., 80-82 4th Ave.,



New York, N.Y., and comes with five quickly interchangeable toolholders for turning, threading, drilling, cutting-off and boring. Three sizes, bit capacities ¼" - 1", boring bars ¼" - 1½". **Circle No. A18.**

Murchey "Precision-Pak" Threading Unit is announced by the Sheffie'd Corp., Dayton 1, Ohio. It is completely automatic, and has such features as direct precision lead, rapid return of the tool spindle,



variable speeds, flexibility of application, and low maintenance cost. The unit is adaptable for mounting in most any position such as horizontal, vertical, or angular, in single, double end or multiples. **Circle Inform-A-Gram No. A19.**

T-Slot and Dovetail Cutters *by* Reltool!

● Reltool T-Slot Cutters, both straight and taper shank, have staggered teeth and undercut with side chip clearance. Greater chip room results in freer cutting action, reduces breakage.

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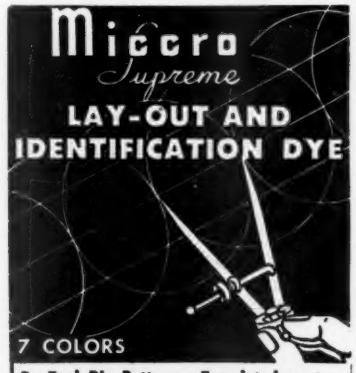

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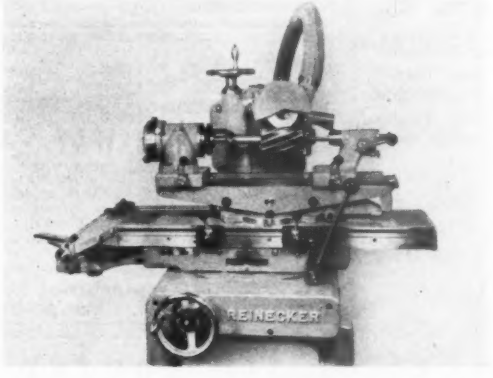
Inform-A-Gram No. A20.

For Chamfering and Deburring Flywheel Ring Gears, this new machine by Modern Industrial Eng'g Co., 14230 Birwood Ave., Detroit 4, will completely machine the teeth of a 14" dia. 156 tooth flywheel ring gear in only 8 seconds cutting time. With the exception of loading and unloading, the work cycle is completely automatic, automatic indexing taking place on the return stroke of the form type cutting Tools. **Circle No. A21.**

Fast, Accurate Grinding of Helical Cutting Tools, which does not depend on the skill of the operator, is one of the major advantages of this universal tool and cutter grinder now distributed by Kurt Orban Co. Inc., 205 E. 42nd St., New York 17. A major design feature enables the work table to be tilted horizontally or vertically through 10°. This permits the



face grinding of taper tools between exactly aligned centers. The spiral grinding fixture permits the accurate grinding of helical cutting edges, even with steep pitches, on both straight and tapered tools. This grinder is adaptable to the production or sharpening of hobs, drills, counterbores, reamers, milling cutters and other tools, while spiral and tapered hobs can be sharpened with standard attachments. Helical pitch is generated by longitudinal movement of the table by hand, without the use of a cutting tool support. Two crossing guides and a system of rollers are employed. **Circle Inform-A-Gram No. A22.**

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Adjustable MULTI-DRILL
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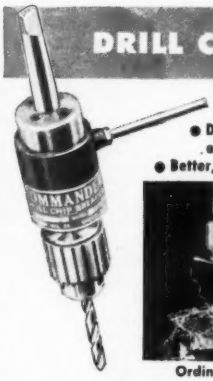
● Better, Smoother, More Accurate Holes



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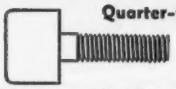

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Coupling Nuts, case-hardened.

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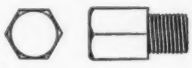

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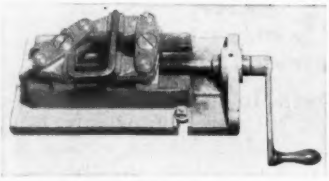

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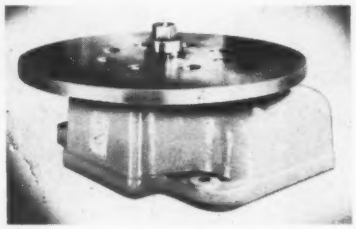
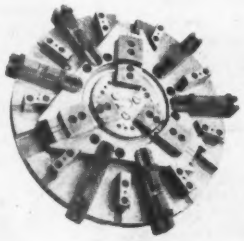


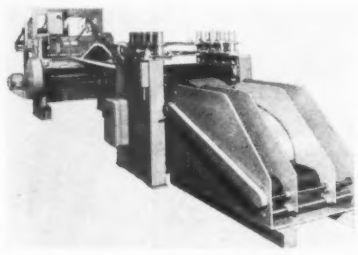
system resulting in smooth, positive, shockless action. It has eight indexing stations, and has interchangeable plates from 10″ to 14″ diameter which are ⅝″ thick. **Circle Inform-A-Gram No. A23.**

New Chucks For Turbine Wheel Machining or for other large parts have recently been developed by the Cushman Chuck Co., Hartford, Conn. Will hold rigidly large



work pieces or small cross-section without distortion strain or the usual harmonic vibrations encountered when machining at high speeds. **Inform-A-Gram No. A24.**

One Man Shear Line. Designed and manufactured by the Union Tool Corp., Warsaw, Indiana, this new machine de-coils, levels, shears, and stacks automatically with only



one attendant. It will handle any flat stock such as steel, aluminum, etc. It will work steel coils up to 13 gauge; will handle widths from 6″ to 60″. It can be set to shear lengths from 6″ to 60″ with a plus or minus variation of only 1/64″. Only one adjustment is required to change lengths. **Circle Inform-A-Gram No. A25.**

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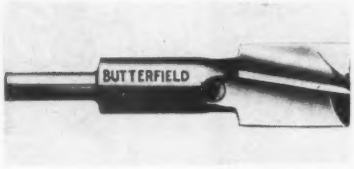
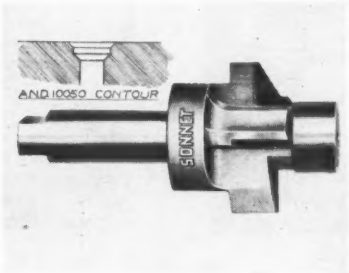


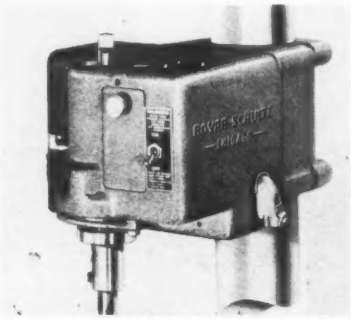
Butterfield Div. Union Twist Drill Co., Derby Line, Vt. 4 styles made, long and short set in straight and taper shank, with two additional styles for the aircraft industry with ¼" shanks. **Circle No. A26.**

This Standard Carbide-Tipped Tool produces AND-10050 port or connecting holes for hydraulic valves and fittings etc. in one operation. Each of the four flutes per-



forms an operation, producing the form shown in the cutaway illustration. The tool is piloted in the minor thread dia. to ensure concentricity. Data from Sonnet Supply Company, 576 N. Prairie Ave., Hawthorne, Calif. **Circle No. A27.**

This Lead Screw Tapping Head by Boyar-Schultz Corp., makes it possible to change your ordinary drill press into a precision tapping instrument that will produce any



thread including class 4. No special skill is necessary to operate. The device will take taps to ⅞" dia. without attachments, taps from 15/16" to 2" dia. with attachments. Built in reversing switch actuates drill press motor; foot control frees hands. **Inform-A-Gram No. A28.**

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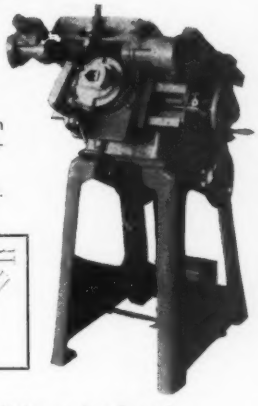

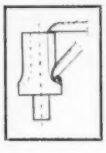

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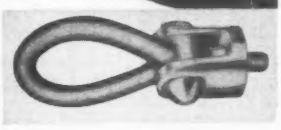

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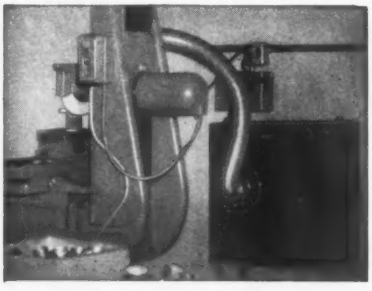

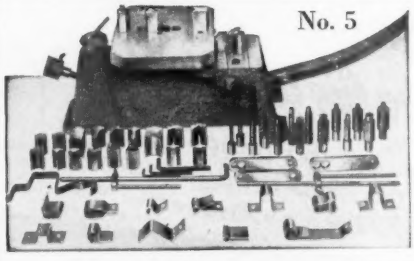

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Illustrating and pricing charts for every make and model of optical comparator and projector . . . radii, angles, American National, Unified-American thread form systems, Dry-seal and other taper pipe threads, protractors, comparator scales and comparator accessories.

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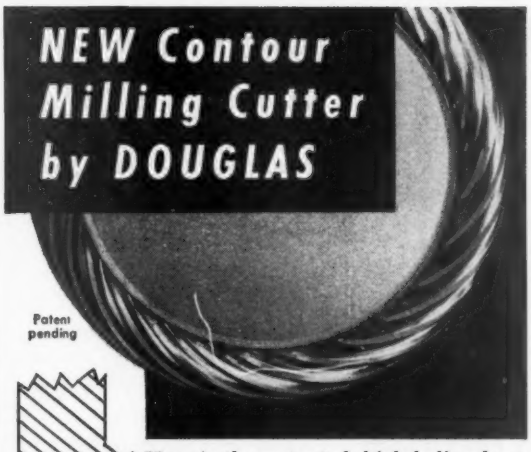
NEW Contour Milling Cutter by DOUGLAS



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CUTTING SURFACE

Here is the patented, high helix, shear type milling cutter that does a real job on turbine compressor blades, stator vanes, buckets and nozzles, cam generating or any compound contoured surface. The teeth are always in contact with the work, they clean themselves and impart a smooth finish. Douglas milling cutters, by using a special adapter, will fit any milling machine. Standard sizes 1½" to 3½". Other sizes upon request.

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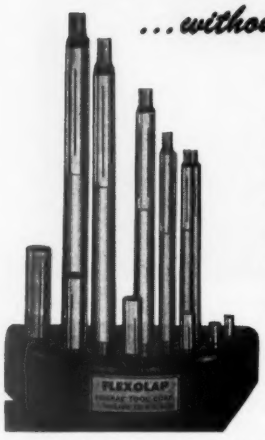
MANUFACTURERS OF DRILL JIG AND FIXTURE BUSHINGS

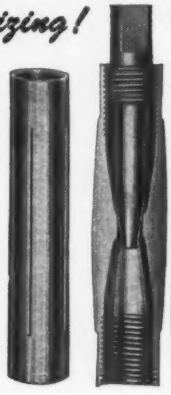
Flexolap... INSTANTLY AND ACCURATELY

ADJUSTABLE FOR FAST CUTTING AND POLISHING

...without danger of galling or seizing!



The Flexolap barrel is made with a series of longitudinal slots milled "off-center" to permit sensitively flexible expansion up to 15%—or more—under pressure of the adjusting pin. This construction enables Flexolap to save valuable time and to lap rounder, straighter holes. For accurate precision take-up, as desired, to maintain size and compensate for wear on barrel . . . simply turn adjustment screw.



Illustrated at left is Set No. 1. Six sizes (3/16", 1/4", 5/16", 3/8", 7/16" and 1/2") with six brass and six steel barrels on wood stand, complete $12.75

Also available in sizes 7/32", 9/32", 11/32", 13/32", 15/32", 9/16", 5/8", 11/16" and 3/4". For lapping holes smaller than 13/16", use the Midget Lap. Seventeen sizes: .032, .036, .040, .046, .054, .062, .070, .079, .090, .104, .120, .135, .155, .170, .187, .218, and .250. Trial assortment (17 laps)..... $1.95

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TOOL COLUMBIA STEELS

Redesign Contest

For the fourth consecutive year, Gray Iron Founder's Society, Inc., Cleveland, Ohio, the national trade association for the gray iron castings industry, is sponsoring its annual Redesign Contest.

The contest is open to any person in the metalworking industry and offers awards for the best examples of a redesign of a competitive product for production in gray iron.

The purpose of the competition is to encourage more extensive use of gray iron by giving recognition and publicity in national trade papers to designers and others who have successfully substituted gray iron for other materials.

Next Month — 7th Annual PRESS DIES AND STAMPINGS Feature Issue!

Cash awards in the amount of $500 will be divided among the winners based upon the merits of the entrees. The amount of the award to each winner will be determined by the judges at the time the awards are selected.

In announcing the 1953 contest, D. H. Workman, the Society's executive vice president, made it clear that no advanced registration is required. All entries for the contest must be submitted by May 1, 1953: presentation of awards will be made at the Society's 25th Anniversary Meeting in St. Louis in October.

The Society's Advertising Committee will act as judges in determining the winners of the contest. Members of this committee are: E. J. Bothwell, chairman, New York, New York; E. H. Thompson, Hamilton, Ohio; Steven Feiss, Cleveland, Ohio; W. A. Kramer, Dayton, Ohio; and L. F. Williams, Mt. Vernon, Ohio.

Firth Sterling Ohio Service

Firth Sterling Inc., tool and specialty steel producers, and A. Milne & Co., nationwide distributors of solid and hollow tool steels have combined their operation in the state of Ohio to provide improved service to the retail tool steel trade in that area.

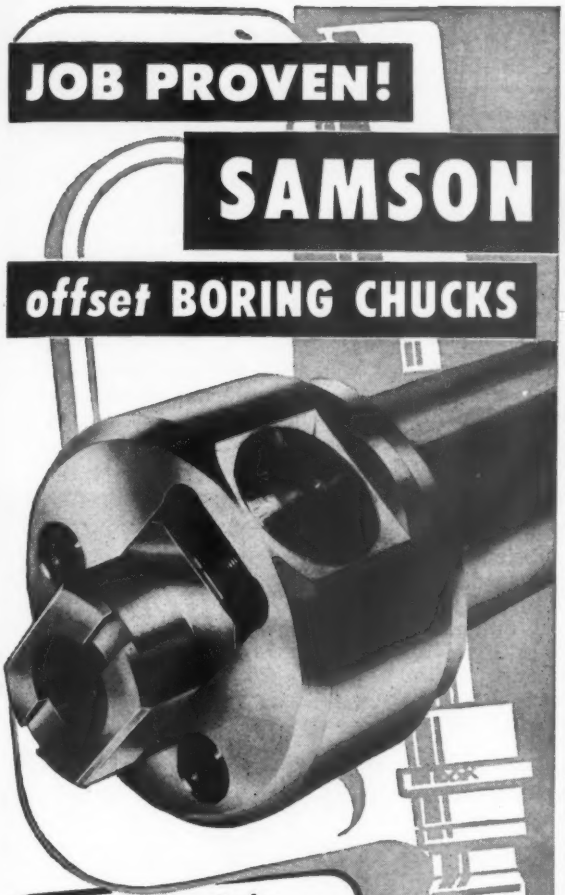
Stocks of both company's well known brands of steel will be distributed from A. Milne & Co. warehouses located at 11110 Avon Ave., Cleveland, 20 S. Charter St., Dayton, Ohio, 1000 Constance St., Pitts., Pa.

Firth Sterling business in other than retail Tool Steel will be handled as heretofore through Firth Sterling branch offices at 1424 East 25th St., N.E., Cleveland, and 137 N. Main St., Dayton.

JOB PROVEN!

SAMSON

offset BORING CHUCKS



precision built by precision toolmakers for accuracy and durability in service!

● Designed for quick tool change; equipped with new, extra large dial for precision radial adjustment; machined to provide positive dead centering for rigid, high production milling and boring without removal of chuck; available with a complete selection of interchangeable accessories—these are features that make the Samson Offset Boring Chuck the logical first-choice of the field.

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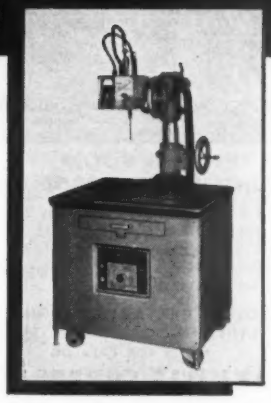
and what it can do for you

Remove broken taps fast without distortion

Cut any shape hole in cemented carbides

Cut dovetails in hardened dies

Cut oil holes in hardened gears without annealing



Literally hundreds of thousands of dollars are saved annually by corporations that are using Metalmasters in just tool and die repair alone.

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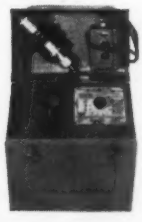

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Samuel A. McKee Retires

Samuel A. McKee, chief of the Lubrication Section of the National Bureau of Standards, retired on January 30 after 32 years service with NBS.

Mr. McKee is a prominent specialist in the field of lubrication. As Chief of the NBS Lubrication Section he has been responsible for the Bureau's basic and applied research in engines and lubrication, including testing of lubricants and liquid fuels, research on viscosity and maintenance of viscosity standards.

Next Month — 7th Annual PRESS DIES & STAMPINGS Feature Issue

Mr. McKee joined the NBS staff in 1921 as an assistant mechanical engineer engaged in research on the lubrication of bearings, gears and other machinery. He rose in the NBS staff until he became Acting Chief of the Lubrication Section in 1945. He became Section Chief in 1947.

Mr. McKee was born in Buffalo, New York in 1890. He received a B. S. degree in Mechanical Engineering at Rhode Island State College in 1921. He is a member of Phi Kappa Phi, the Society of Automotive Engineers, the Government Cooperative Committee on Lubrication, the Technical Committee on Lubricants and Liquid Fuels of the Federal Specifications Board, the Technical Committee on Ball and Roller Bearings of the Federal Specifications Board, Technical Committee G, Section III of Committee D2 of the American Society for Testing Materials, and the American Society of Mechanical Engineers Special Research Committee on Lubrication.

Work done by 90 FS Automatic Flute Grinder

GROUND FROM SOLID!

Flutes a variety of special size drills, reamers, spiral or straight milling cutters, end mills and saws in gangs up to 7¾" long. No tool shop should be without this machine. It saves costly delay when special drill or reamer is required. Straight or spiral flutes from solid. Indexes automatically, no special skill required. Write for full description on 90 FS Automatic Universal Flute Grinder.

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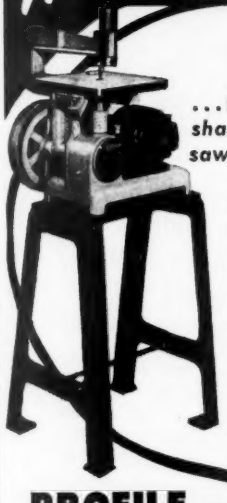
Maker of largest line of saw and tool sharpening machines

CUT TOOL AND DIE-MAKING COSTS WITH . . . Milwaukee DIE FILERS PROFILE GRINDERS



DIE FILERS
. . . for straight-line sharp corner filing, sawing and lapping

This low cost precision-built unit performs all die making operations at savings up to 40%. Furnished complete with motor and two overarms. No extras to buy.

Write for illustrated Bulletins and Prices.

PROFILE GRINDERS
. . . for high speed Precision Grinding of curved and Irregular Contours

Standard features include 20,000 or 30,000 R. P. M. spindle speeds, ½ H. P. motor, Collet Chuck, Compound tilting table, built-in wheel dresser. Write for illustrated Bulletins and Prices.

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Next Month!

7th Annual

PRESS DIES & STAMPINGS

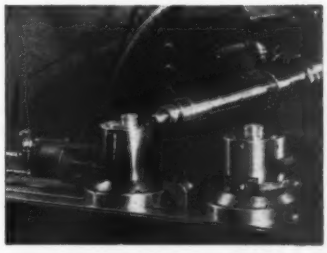
Feature Issue

Zagar 1" collet holding fixture cuts costs in center drilling shafts.

take a short cut—

depend upon Zagar-holding and indexing fixtures for milling, drilling, tapping and grinding

"Skip" the many special set-ups, jigs and fixtures formerly needed to hold and index. Maintain accuracy and close tolerances. No vertical movement in closing. Stop insures exact duplication of parts. Pipe tap hole provides for lubrication of cutting tools and washes out chips. Index any number of positions from 2 to 25 (4, 6 and 8 divisions standard). 1" and 2" sizes.



Operator merely loads and unloads.

also, the Zagar-"Air-O"

Zagar "Air-O" (air-operated) fixture has all basic features above; still further speeds up operation. Control by hand, cam, chain or other cycling connection. All parts are interchangeable. Typical Zagar ruggedness and craftsmanship. 1" and 2" sizes.

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24000 LAKELAND BLVD.
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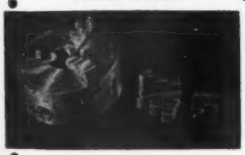
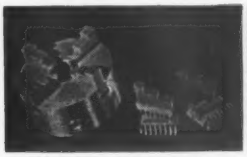

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Model	Size	Wt. lbs.	Price
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29	3¼"	3½	26.50
30	4"	6½	30.00
30A	5"	11¾	37.50
31	6"	17¼	45.00
30BP*	4"	8¼	33.50
30ABP*	5"	15	42.50
31BP*	6"	21	50.00
52	7½"	25	57.50
53	9"	43	67.50
54	10½"	62	95.00
55	12"	88	125.00

Universal Four Jaw, Two Sets of Jaws, Two Pinion

Model	Size	Wt. lbs.	Price
29Y	3¼"	3¾	$ 30.00
30Y	4"	7	37.50
30AY	5"	12½	43.50
31Y	6"	18¼	52.50
52Y	7½"	29	85.00
53Y	9"	42	95.00
54Y	10½"	62	110.00
55Y	12"	88	150.00
30AYBP*	5"	15¾	48.50
31YBP*	6"	22	57.50

Soft Jaws Available
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35C	4½"	5	18.50
34	6"	10	22.50
35BP*	4"	6½	18.00
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34BP*	6"	14	26.50

*Models marked with asterisk (*) are fitted with 1½—8 Back Plate for all popular 9" and 10" lathes.

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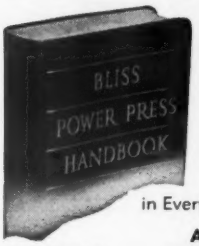

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JIG BORING

JOB WELDING

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. . . **Carbide Cutters,** **from page 81**

tungsten carbide blades of Kennametal.

Operation is performed on a 20-horsepower Cincinnati Hydraulic side mill at 100 revolutions per minute with the Kennamill projecting about 12 inches beyond the machine face. Feed is 10 inches per minute, chip load is 0.010-inch with a ⅛ to 7/16-inch maximum per pass depth of cut. Because of the limited horsepower and unavoidably excessive cutter overhand, severe vibration was experienced when the 12-inch mill was first tried. This condition was minimized by setting the twenty solid carbide blades as follows:

First, ten blades were set up in alternate slots with their cutting end projecting approximately 0.032-inch from the cutter body. Then, the other ten blades were inserted in the remaining slots and allowed to project approximately 0.040-inch beyond the first set.

To obtain the 9-inch wide by 13-inch long flat (finish milled area), total depth of cut is approximately 1½-inches. This is made in five passes with the first cut being 7/16-inch deep. Each successive cut is made at reduced depth as the size of the milled area increases. With only ten blades doing the cutting and the depth of cut decreased for each successive pass, the required horsepower is reduced and vibration minimized.

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Double faced dial indicator complete with cadmium plated holder including 1/32" and 1/8" contacts.

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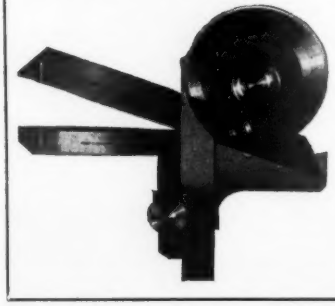

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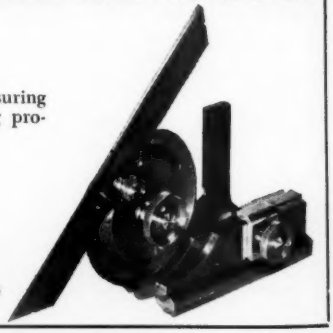

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ALLOY CENTERS

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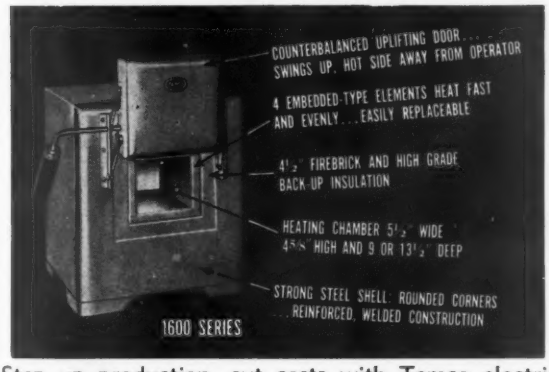
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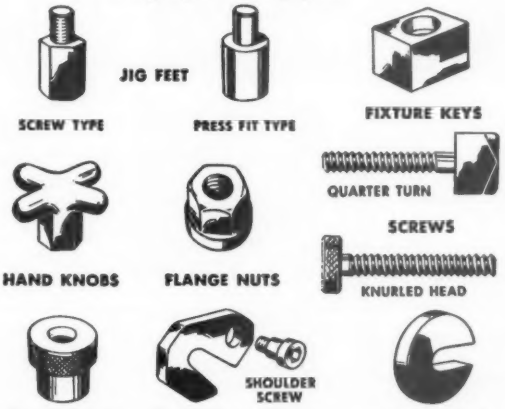

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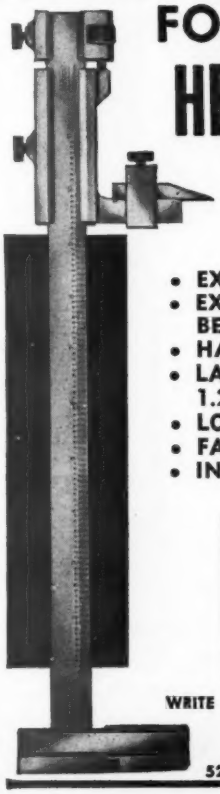

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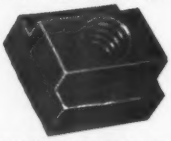

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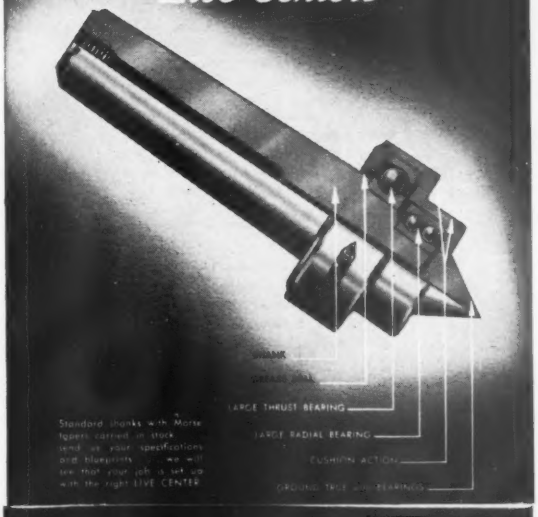

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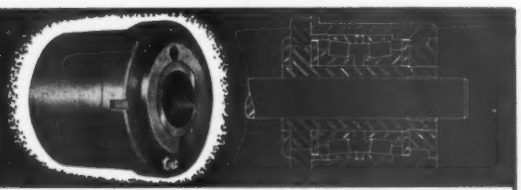

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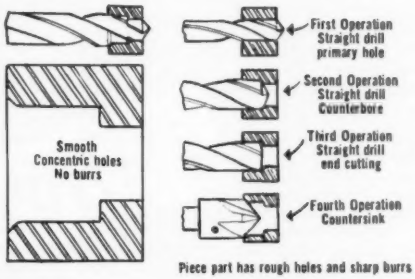

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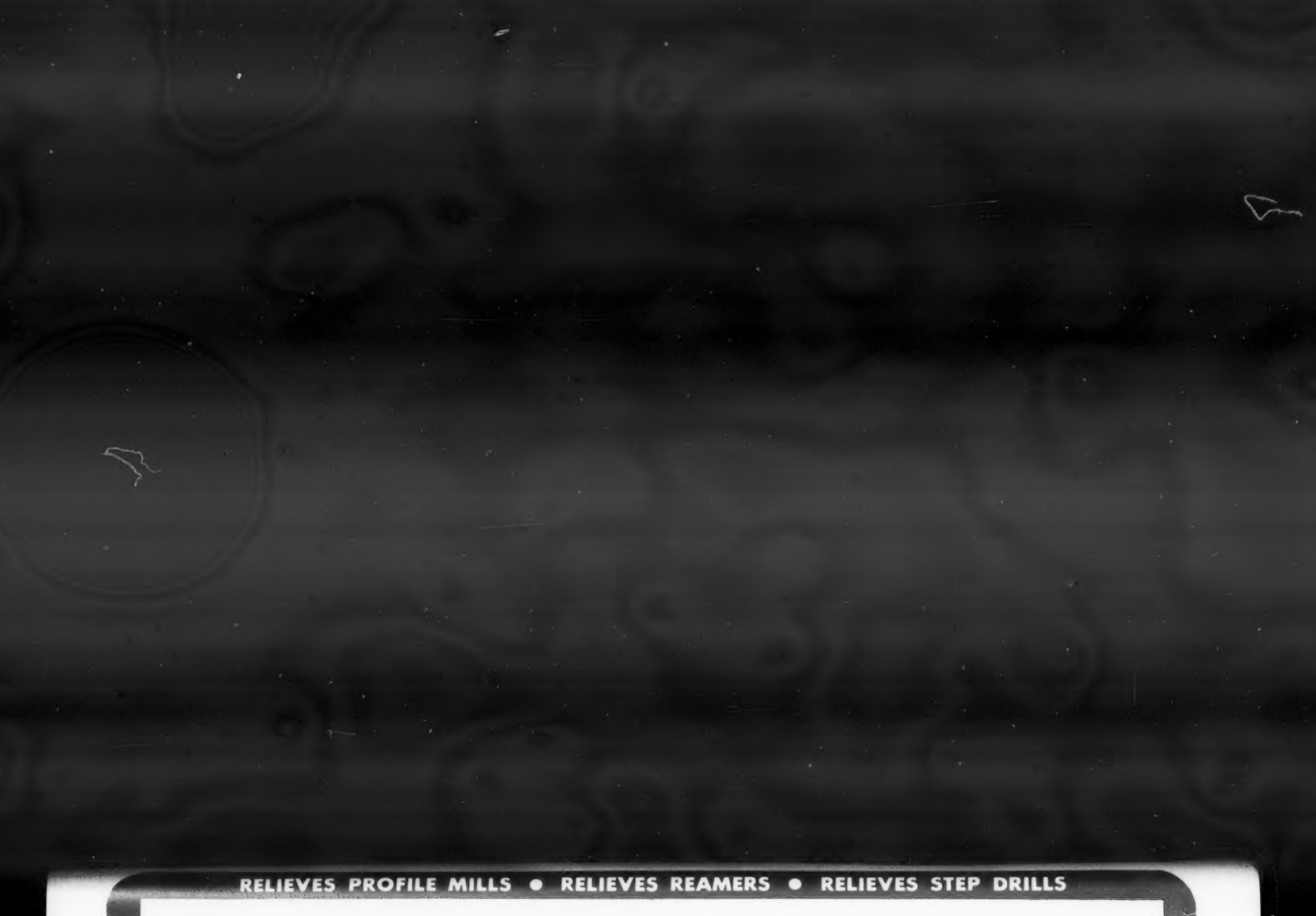
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